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Dissertation

AN EDUCATIONAL EXPERIMENT TO DISCOVER THE EXTENT TO WHICH THE RESULTS OF TEACHER EXAMINATIONS ARE INDICES OF TEACHING EFFICIENCY IN GRADES FOUR TO SIX, THE CRITERION OF SUCCESSFUL TEACHING BEING THE GROWTH OF PUPILS IN READING AND ARITHMETIC AS DETERMINED BY STANDARDIZED TESTS

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In partial fulfillment of requirements for the degree of

Doctor of Education

1945

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ACKNOWLEDGMENTS

The influence of teacher selection on the welfare of society has been considered to be so important that for several years the city of Providence has been interested in the study of the best methods that might be used to appraise the merit and fitness of applicants for teaching positions. As a consequence, Dr. James L. Hanley, Superintendent of Schools, requested that an evaluation be made of the teacher examinations which had been used in Providence since 1932 and the results of which furnished considerable weight in the appraisal of candidates for teaching positions. This particular investigation is an outcome of the interest of the superintendent and his staff.

Such a study would be impossible without the help and cooperation of many people. Permission to use the confidential records of the teacher examinations was granted. Dr. Charles F. Towne, Deputy Superintendent of Schools, sponsored the investigation. Thirty-seven elementary school teachers cooperated and willingly accepted the extra work imposed on them. Dr. Richard D. Allen, Assistant Superintendent of Schools, in whose department the study was made, contributed by his years of work in the development and accumulation of such data.

The entire study has been made under the supervision of Dr. Whittier L. Hanson, whose wise and kind counsel, and whose criticisms and suggestions have directed the investigation from beginning to end. Dr. Roy L. Billett and Dr. J. Wendell Yeo contributed by their constructive criticisms after the study was assembled. Dr. Truman L. Kelley, of the Harvard Graduate School of Education,

suggested the statistical procedure to be followed, contributed formulas, and gave helpful suggestions on the data during the course of its preparation.

Appreciation is extended to all of these people who helped in the study,--for the inspiration they afforded and for all the other assistance which they so graciously offered.

PART ONE

ANALYSIS OF THE PROBLEM

CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Various Methods of Measuring Teaching Efficiency

The purpose of the experiment.-- The purpose of this investigation or experiment is to discover the relationship between teaching ability as determined by growth in pupil achievement and the results of teacher examinations in scholastic aptitude, professional information, and general culture. To what extent is intelligence or scholastic aptitude as measured by the American Council Psychological Test[1] an index of teaching efficiency? To what extent are professional knowledge and general cultural knowledge as determined by the results of certain Cooperative tests[2] indices of successful teaching? In other words, this experiment aims to evaluate the validity of teacher examinations the results of which are used as a means for helping in the selection of desirable candidates for teaching positions. The criterion of teaching efficiency used in this study is the growth of pupils' achievement in reading and arithmetic over a period of five months as determined by the Durrell-Sullivan Reading Achievement Test[3]

1/ American Council on Education Psychological Examination. Science Research Associates, Chicago, Illinois.

2/ Cooperative General Culture Test. Cooperative Test Service, New York, N. Y.

3/ Donald D. Durrell, and Helen Blair Sullivan, Reading Achievement Test, Intermediate Test: Form A, Grades 3 to 6. World Book Company, Yonkers-on-Hudson, New York.

and the Stanford Achievement Test in Arithmetic.[1]

The importance of the experiment.— Since the training and selection of teachers is probably one of the most important problems in modern education, any reliable study of methods used in the selection of candidates for positions should be of interest to all educators and to the entire teaching profession. Such a study is of particular interest to the school administrators of the city of Providence, where the results of teacher examinations are used in the selection of candidates for teaching positions. Such an investigation should also furnish data that would help in the preparation of improved instruments for measuring teacher potentiality.

It is important to note that such a study has been made possible because of the widely employed use of pupils' and teachers' examinations in Providence over a period of several years, achievement surveys having been made annually since 1927 and teacher examinations having been administered since 1932.

Approaches to the measurement of teaching ability.— The nature of teaching ability is very complex and although analyses have been made of the different traits that constitute good teaching, there is still considerable doubt as to how best to proceed to measure or predict this ability. Not so many years ago any person interested in teaching had only to take a very simple test to show that he could read, do a few simple problems in arithmetic, and show that he was a

1/ Truman L. Kelley, Giles M. Ruch, and Lewis M. Terman, Stanford Arithmetic Achievement Test, Intermediate. World Book Company, Yonkers-on-Hudson, New York.

fair speller in order to become eligible for a school position. As time passed, standards for entrance to the teaching profession were raised. A high-school education became necessary and then certain courses in pedagogy were required. Today in most large school systems a college degree is required of any candidate who wishes to teach either in the elementary or secondary grades.

Score cards or rating scales.-- Today we have such devices as score cards or rating scales which serve as a means of organizing judgments and thus help in a more systematic method of rating teachers. By this method, group judgments may be expressed as a single numerical index. In spite of doubts and criticisms as to the validity of such measures it is generally agreed that these ratings are helpful to administrators and that score cards with all their weaknesses are a big improvement over the general-opinion method used by supervisors only a few years ago.

Standardized tests.-- A recent method of measuring teaching efficiency is by the use of standardized tests where the achievement of pupils becomes an index of successful teaching. According to this approach, attention is focused on the behavior of the pupil rather than on the teacher. The principle which underlies this procedure is that a teacher's success is proportionate to the growth or change she causes in her pupils. This procedure is not intended to minimize the importance of a teacher's own health, education, interest in teaching as a profession, capacity for leadership, and the like. All of these aspects and many others are most important but their importance is due

primarily to the effects produced on the pupils in causing desirable changes or growth which is the primary aim of all educational work.

The fact that the use of standardized tests as measuring instruments of pupil growth has weaknesses as they are frequently employed is recognized by all. The criticism most often made of these tests is that their use causes nervousness, worry, and other mentally unhygienic reactions. To offset such an abuse of tests, they may be administered at the beginning of the school year rather than at the end and thus serve as an inventory rather than as a method for evaluating.

The second weakness ascribed to tests is that the results of instruction are intangible and cannot be measured. This is very true. One cannot measure mental accomplishment as one would measure physical growth. There may be inaccuracies in such measurements and the measurement may be incomplete; however, it is preferable to no measurement at all if the teacher recognizes that such errors and deficiencies are present and if he does not have too great confidence in the results.

Pupil evaluation of teaching efficiency.-- A still more recent method of rating teacher efficiency is by means of pupil evaluations. There are arguments for and against such ratings but certain investigations have proven their value. E. C. Bowman[1] found that student-teachers improved in their work after being rated by their pupils and the pupils' morale improved also. Ferguson and Hovde[2] concluded from

1/ E. C. Bowman, "Pupil Ratings of Student-Teachers", Educational Administration and Supervision (February, 1934) 20: 141-147.

2/ Harold Ferguson, and Herman O. Hovde, "Improving Teaching Personality by Pupil Ratings", The School Review (June, 1942) 50: 439-43.

their investigations that a teacher's personality can be improved by pupils' ratings. Porter[1] found in his study that there was close agreement between pupils' evaluations and those of the supervising teacher. The pupil-teachers felt that they derived much help from such evaluations. Rating scales have been prepared for pupils as low as the fourth grade.[2] Other scales have been designed for use at the secondary school and college levels.[3]

Anecdotal records as aids in measuring the success of teachers.[4] The use of anecdotal records of a teacher's performance is still a more recent development in the studying of teaching efficiency.

National Teacher Examinations.[5] Probably the latest development in the selection of teachers has been the preparation and development of the National Teacher Examinations. This battery of examinations, prepared by experts under a committee of the American Council on Education and sponsored by the National Committee on Teacher Examinations, is designed to assist school administrators in the selection

1/ William A. Porter, "Pupil Evaluation of Practice Teaching", Journal of Educational Research (May, 1942) 35: 700-714.

2/ Sister M. Amatora and H. H. Remmers, Diagnostic Rating Scale. Division of Educational Reference, Purdue University. Lafayette, Indiana, 1940.

3/ R. C. Bryan and O. Yntema, A Manual on the Evaluation of Student Reactions in Secondary Schools. Western State Teachers College, Kalamazoo, Michigan, 1939.

4/ Louis Raths, "The Ohio Teaching Records Anecdotal Observation Form". Ohio State University Press, Columbus, Ohio, 1941.

5/ Information is printed each year descriptive of the National Teacher Examinations and can be obtained from the National Committee on Teacher Examinations of the American Council on Education, 15 Amsterdam Avenue, New York, N. Y.

of well qualified teachers. The examinations are given once a year in certain centers in the various sections of the United States. The tests are scored by machine and the results are treated statistically.

Providence Teacher Examinations.— The National Teacher Examinations have been used in the city of Providence from the time of their first development in 1940 as a partial means of selecting candidates for teaching positions. These examinations, however, are not a new experience for Providence. Before the National Examinations were planned, similar examinations, provided by the American Council on Education through the Cooperative Test Service, were used to help in judging and selecting teachers during the period 1932-1940.

The superintendent of schools in Providence and his staff require that all applicants for positions register their qualifications by means of objective examinations in general education and in two subject fields of instruction in the curriculum of the schools.

The school administrators do not permit themselves to be wholly influenced by the results of the examinations. Other factors, such as training and experience and personal factors, are emphasized as much as the academic and intellectual abilities that are measured by the examinations. The results of the examinations, however, contribute one-half to the evaluation of a candidate's fitness to teach; consequently their use and value are of importance to both the candidate and the school administrators.

A study of thirty-seven elementary school teachers.— This experiment is based on a study of thirty-seven teachers in the elementary

schools of Providence, grades four to six. All teachers participating in the experiment received their first appointment to teach between the years 1933 and 1939, and have consequently been required to take the teacher examinations. All are graduates of the Rhode Island College of Education, each one having a Bachelor of Education degree after four years of college work. Since it is the policy of the School Committee to confirm for appointments those who are residents of the city, all are local teachers. This study will attempt to evaluate the validity of the teacher examinations as a means of helping to identify these thirty-seven teachers as successful in the classroom.

Procedure followed.-- The experimental procedure followed in this study may be briefly outlined:

1. The administration of standardized achievement tests to pupils at the beginning and at the close of the school term to discover growth in reading comprehension, vocabulary, arithmetic reasoning, and arithmetic fundamentals.

2. The administration of a group intelligence test to all the pupils.

3. A prediction of growth made for each pupil in these school subjects by means of multiple regression equations, controlling such variables as chronological age, mentality, grade, and socio-economic status.

4. A study of the differences found between the actual growth scores obtained from the tests and the growth scores predicted from the regression equations.

5. The calculation of the mean of these differences for each group; this mean score to be called the teacher-influence score.

6. A study of the relationship between the teacher-influence scores and the scores obtained on the teacher examinations.

CHAPTER II

DEFINITIONS

Short Descriptions of Terms Used in the Discussion of the Problem and Formulas Not Commonly Used

A number of the terms employed in this experiment are defined or described below so that there may be an understanding of their use in this study.

Growth in reading comprehension and vocabulary.-- Growth in reading comprehension and vocabulary is defined in this study as the amount of change in scores obtained from two administrations of the Durrell-Sullivan reading test, the initial test being given in September, 1942, and the final test administered in January, 1943.

Mean growth score in reading and vocabulary.-- The mean growth score refers to the average growth score in reading and vocabulary of a group or class of twenty pupils under a teacher who is participating in the experiment.

Growth in arithmetic reasoning and arithmetic fundamentals.-- Growth in arithmetic reasoning and arithmetic fundamentals is determined by the amount of change in pupils' scores between the first and final administrations of the Stanford Achievement Tests.

Mean growth in arithmetic reasoning and arithmetic fundamentals.-- The mean growth in arithmetic reasoning and arithmetic fundamentals is similar to the mean growth in reading and vocabulary. This growth re-

fers to the average of the growth scores of twenty pupils who are under the supervision of one teacher.

Mean chronological age.— The chronological age scores used in this study are the ages of the pupils on January 1, 1943. The mean age for each group is then computed.

Mean intelligence scores.— The intelligence scores have been obtained from one administration of the Pintner General Ability Test, Intermediate, Form A. The test was administered in the middle of the term by three psychological examiners and a few selected teachers who are located in the larger buildings and who have been trained to do this type of work in their own buildings. The mean raw score for each group of pupils is calculated.

Mean grade.— The grade assigned to each pupil is that grade in which he was located during the term of the experiment, September, 1942, to January, 1943. According to the organization of the Providence schools, with semi-annual promotions, the "B" grade is the first half of the grade and the "A" grade is the second term of the grade. Many of the teachers taking part in the experiment have two grades in a room. One teacher has had three grades. If six pupils of a class of twenty are in Grade 4B, and if the other fourteen pupils are in Grade 4A, the mean grade of the entire group is 4.35.

Mean socio-economic status.— The scores on socio-economic status are determined by the location of the homes of the pupils in the forty-nine census tracts of the city. Each census tract has a rating or value depending on the scores of 2,387 pupils in grade 7B who were

measured by the Sims Score Card in the year 1942.

Percentile scores on the teacher examinations.— All scores obtained on the teacher examinations (American Council Psychological, Cooperative General Culture, Cooperative Professional Information) have been changed to percentile scores based on the results of about 350 local candidates.

Estimated mean growth.— The estimated mean growth in reading comprehension, vocabulary, arithmetic reasoning, and arithmetic fundamentals refers to the predicted or estimated mean growth scores derived from the multiple regression equations.

Observed mean growth.— This observed mean growth is the actual amount of change in scores when two standardized tests have been given, an initial test at the beginning of the term and a final test at the close of the term and the mean growth score determined for each group.

Teacher-influence growth score.— The teacher-influence growth score is the difference between the predicted mean score and the observed mean score in reading, vocabulary, arithmetic reasoning, and arithmetic fundamentals. When the influence of such variables as chronological age, intelligence, grade, and socio-economic status have been nullified by statistical procedures the remaining factor that may have influenced the achievement of pupils in reading and arithmetic is called the teacher factor or teacher-influence. Consequently the growth of pupils over and above (or below) the estimated growth is called the teacher-influence growth score.

Formulas employed in this study.-- Following is a list of the formulas not commonly used but employed in the preparation of this study.

1. Variance[1]

$$V = \sigma^2$$

2. Covariance[2]

$$CoV_{xy} = \sigma_x \sigma_y r_{xy}$$

3. Regression Equation with five variables[3]

$$\bar{X}_o = b_{01.234}X_1 + b_{02.134}X_2 + b_{03.124}X_3 + b_{04.123}X_4 + C$$

$$C = M_0 - b_{01.234}M_1 - b_{02.134}M_2 - b_{03.124}M_3 - b_{04.123}M_4$$

4. Coefficients of Multiple Determination and Multiple Correlation[4]

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0}$$

$$R_{0.1234} = \sqrt{R^2_{0.1234}}$$

5. Standard Error of Estimate[5]

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2_{0.1234}}$$

1/ Charles C. Peters, and Walter R. Van Voorhis, Statistical Procedures and Their Mathematical Bases. McGraw-Hill Book Company, New York, 1940, p. 69.

2/ Snedecor, Statistical Methods. The Iowa State College Press, Ames, Iowa, 1940, p. 127.

3/ Henry E. Garrett, Statistics in Psychology and Education. Longmans, Green and Company, New York, 1941, p. 427.

4/ Garrett, op. cit., p. 437.

5/ Peters and Van Voorhis, op. cit., p. 114.

6. Significance of multiple R (from a hypothetical true multiple R of zero)[1]

$$F_{n,N-n-1} = \frac{V_{0\Delta 12\ \ldots\ n}/n}{\frac{V_{0.12\ \ldots\ n}}{N-n-1}} = \frac{V_0 R^2/n}{\frac{V_0(1-R^2)}{N-n-1}} = \frac{R^2/n}{\frac{1-R^2}{N-n-1}}$$

in which

N = number of cases

n = number of independent variables

7. Significance of r (z technique, R. A. Fisher, using logarithms to the base 10)[2]

$$Z_r = 1.1512925 \left(\log \frac{1+r}{1-r}\right)$$

Standard Deviation of r

$$\sigma_{z_r} = \frac{1}{\sqrt{N-3}}$$

8. Significance of b coefficients[3]

$$F_{1(N-n-1)} = \frac{\left[b_{01.2\ldots)i}(\bar{\ldots}\bar{n}-\tilde{b}\right]^2 \left[V_{i.12\ldots)i..n}\right] \left[N-n-1\right]}{\left[V_{0.12\ldots n}\right] \left[1-r^2_{01.12\ldots.)i(\ldots n}\right]}$$

9. Symbol for "equivalent to"[4]

=○=

1/ Truman L. Kelley, Fundamentals of Statistics. Manuscript--not yet published.

2/ George R. Davies, and Dale Yoder, Business Statistics. John Wiley and Sons, Inc., New York, 1941, p. 554.

3/ Kelley, loc. cit.

4/ Kelley, loc. cit.

CHAPTER III

PREVIOUS INVESTIGATIONS

A Brief Summary of Studies That Have Been Made in This Field

The subject of measurement and prediction of teaching ability has received considerable attention during the last few years. Such studies, however, have met with difficulties. It has been hard to establish a criterion of teaching efficiency, objective measures have not been developed to any extent, and it has been difficult to control the many factors that affect changes in pupils in the classroom.

The investigations that have been made can be classified generally as (1) those where the criterion of teaching efficiency has been the ratings of administrators and (2) studies where the criterion has been the achievement of pupils in school work.

Studies where the criterion of successful teaching is the ratings of supervisors.— Junius L. Meriam[1/] studied elementary school teachers from eleven normal schools to discover the relationship between general teaching ability and scholarship in the normal school. Correlations were so low as to appear negligible.

A. C. Boyce[2/] investigated correlations between general teaching

1/ Junius L. Meriam, Normal School Education and Efficiency in Teaching. Teachers College Contributions to Education, No. 1. New York (1906)

2/ A. C. Boyce, Methods of Measuring Teachers' Efficiency. Fourteenth Year Book, Part II, National Society for the Study of Education (1915)

ability and forty-five traits on a rating scale. High correlations proved the existence of a halo. The scales used were found not to be measuring instruments.

Frederick B. Knight[1] studied teachers in three Massachusetts towns to discover correlations between general teaching ability and such factors as age, experience, handwriting, intelligence, academic interests, normal school scholarship, and professional study. Ratings for teaching ability were made by other teachers, supervisors, and pupils. The rank order method was used. Correlations were too low to establish relationship.

Whitney,[2] Madsen,[3] and Boardman[4] made similar studies with like success.

Elizabeth H. Morris[5] constructed a trait index and correlated such factors as trait index and practice teaching, academic marks and practice teaching, intelligence and practice teaching, trait index and intelligence. She concluded in her study that success is due to several characteristics which are common to all students but which are

1/ Frederick B. Knight, Qualities Related to Success in Teaching. Teachers College Contributions to Education, No. 120. New York (1922)

2/ F. L. Whitney, The Prediction of Teaching Success. Bloomington, Illinois (1924) p. 85.

3/ I. N. Madsen, "The Prediction of Teaching Success", Educational Administration and Supervision (January, 1927) 13: 39-47.

4/ Charles W. Boardman, Professional Tests As Measures of Teaching Efficiency in High School. Teachers College Contributions to Education, No. 327. New York (1928) p. 85.

5/ Elizabeth H. Morris, Personnel Traits and Teaching Success. Teachers College Contributions to Education, New York (1929) p. 75.

possessed in different proportions, and not due to certain qualities possessed by some students only.

H. L. Kriner[1] contrasted 130 of the best teachers with 130 of the poorest teachers and compared their high school ratings. He found that the better teachers received higher grades in scholarship than the poorer teachers.

Sandiford[2] studied students who entered the Ontario College of Education. The students were measured in achievement, intelligence, and in regard to certain personality traits. They were interviewed and asked to fill out questionnaires. The purpose of this program was to help in furnishing a means of restricting the number of students who attended the Institution. It was found that every correlation with teaching success was below .20 except that of practice teaching which was .37.

A. L. Odenweller[3] studied 560 teachers in Cleveland and computed correlations between successful teaching and personality. Accuracy in predicting successful teaching was found to be impossible. Intelligence had the same relation to teaching success as the weight of the teacher or the number of letters in the teacher's signature. He concluded that additions to the amount of intelligence needed for graduation from a teachers' college did not result in better teaching.

1/ H. L. Kriner, Pre-Training Factors Predictive of Teacher Success. Pennsylvania State Studies in Education, No. 1. (1931) p. 91.

2/ Peter Sandiford, and others, Forecasting Teaching Ability. Toronto Department of Educational Research, University of Toronto (1937) p. 93.

3/ A. L. Odenweller, Predicting the Quality of Teaching. Teachers College Contributions to Education, No. 676. New York (1936)

Rudyard K. Bent[1] experimented with 1084 students at the University of Minnesota and found low correlations between successful student teachers as rated by supervisors, and scores in the major subjects taken at college.

Pupil achievement the criterion of teaching efficiency.-- Another type of study compared pupil achievement with ratings made by supervisors.

Lelah M. Crabbs[2] studied sixty-four teachers and in her investigation used the A. R. (accomplishment ratio) technique. Her purpose was to discover (1) to what extent a teacher's efficiency in teaching one subject was an index of her efficiency in teaching other subjects, (2) what relationship existed between teaching success and supervisors' ratings. She found that the highest intercorrelations were between arithmetic and penmanship, and arithmetic and reading. The judgments of the supervisors concerning teaching efficiency were found to be too inaccurate to be of practical value.

James Baird and Guy Bates[3] experimented with 571 Detroit teachers in grades 1A to 3A. They tried to discover to what extent general merit ratings correlated with successful teaching which was determined by

1/ Rudyard K. Bent, "Relationships Between Qualifying Examinations, Various Other Factors, and Student Teaching Performance at the University of Minnesota," Journal of Experimental Education (March, 1937) 5: 251-255.

2/ Lelah M. Crabbs, Measuring Efficiency in Supervision and Teaching. Teachers College Contributions to Education, No. 175. New York (1925) p. 75.

3/ James Baird and Guy Bates, "The Basis of Teacher Rating," Educational Administration and Supervision (March, 1929) 15: 175-183.

the achievement of pupils in reading. The correlation was r = .135.

Gilbert Lee Betts[1] studied thirty-five classes, grades 4-8, in a rural and urban section of California near Stanford University. Pupil achievement as measured by the New Stanford Tests was found to have a significant correlation with an NS trait in teachers. This NS trait is described as "that characteristic which distinguishes a reputed superior teacher from a novice teacher."

An important and most comprehensive investigation of teaching efficiency was made by Barr, Torgerson, and others[2] at the University of Wisconsin. Sixty-six teachers, with an average experience of ten years, were studied in four different school systems. A low coefficient of correlation was found with pupil achievement as measured by the New Stanford Achievement Test, and each of ten measures of teaching ability. Some of the measures used were Torgenson Scale, Social Intelligence Test, Psychological Test, Morris Trait Index, Knight Aptitude Test, Work Health Test, Strong Interest Test, etc. Eighty-seven per cent. of the correlations were between -.30 and +.30. The data proved too inconsistent to enable one to indicate a preference from among the measures. The purpose of the study was to discover the validity of these selected measures of teaching success.

1/ Gilbert Lee Betts, "Pupil Achievement and the NS Trait in Teachers," Measurement of Teaching Efficiency (edited by Helen M. Walker). The Macmillan Company, New York (1935)

2/ Arvil S. Barr, Theodore L. Torgerson, and others, "The Validity of Certain Instruments Employed in the Measurement of Teaching Ability," Measurement of Teaching Efficiency (edited by Helen M. Walker). The Macmillan Company, New York (1935)

A more recent report on this same study states that the intelligence of the teacher, as measured by tests, is the factor most closely related to teaching ability.[1] Social attitudes are found to be important factors and a knowledge of mental hygiene seems to have high significance.

Gilbert L. Betts[2] reported an experiment with 125 teachers in Philadelphia, Washington, D. C., and Baltimore. He found that the correlation between teachers' tests and pupil achievement in reading was .41. The teachers' tests measured professional information, subject matter vocabulary, intelligence, and vocabulary idiosyncrasy. The idiosyncrasy score was the extent to which a teacher scored high on some vocabulary tests and low on others.

Summary of investigations.— The early studies in the measurement and prediction of teaching efficiency used supervisors' and other administrators' ratings as the criteria of teaching efficiency. Correlations between these ratings and such factors as intelligence, scholarship, age, experience, socio-economic status, personality, and scores on tests have been found to be positive but extremely low.

Later studies show that pupil achievement as measured by standardized tests became the criterion of teaching efficiency. Attention was transferred from the activities of the teacher to pupil activity and

1/ Leon E. Rostker, "The Measurement and Prediction of Teaching Ability," School and Society (January, 1940) 51: 30-32.

2/ Gilbert L. Betts, "Evaluation Through Ratings and Other Means of Success," National Survey of the Education of Teachers, Bulletin 1933, No. 10, Vol. 5. U. S. Government Printing Office, p. 87-116.

achievement. Teacher traits were considered only as a means to an end. The correlations in these studies between pupil achievement and such factors as teacher training and experience, teacher traits, professional knowledge, scholarship, and ratings by supervisors were not sufficiently high to be predictive.

CHAPTER IV

DATA REQUIRED FOR THE EXPERIMENT

A General Description of the Tests and Scores Used in the Investigation

The source of data.— This investigation is based on a study of thirty-seven teachers, located in sixteen different buildings, whose classes ranged in grade from 4B to 6B and in size from twenty-seven to forty pupils. These teachers taught and administered tests to 1162 pupils during the school term of September, 1942, to January, 1943. Twenty pupils were selected from each group for more detailed study by means of the "Fisher and Yates Table of Random Numbers."[1/] This table is so arranged that any digit from zero to nine has an equal chance to appear at any given position in the table. If there are forty-two available pupils in a class and one wishes to select twenty pupils for a detailed study, the first step is to number the pupils from 00 to 41 in any order. From the table, starting at any point, choosing any row and any column, and reading in any direction, one selects or reads twenty two-digit numbers that are less than 42, skipping any number already read.

The reliability of the results of pupils' examinations.— Providence is able to furnish reliable measures of pupil achievement. Annual testing programs have been conducted in all the grades for several years. Standardized tests are given at the beginning of each

1/ E. F. Lindquist, Statistical Analysis in Educational Research. The Macmillan Company, New York, 1940.

1/ V. Tableau, Traité de gestion de l'entreprise moderne.
Ed. Hachette Centenal, Bar Lara, Lima.

school year and serve as an inventory to help discover the strengths and weaknesses of the pupils. Since the tests are administered at the beginning of the year no teacher has any feeling of anxiety as to her being rated on the results. Promotions and demotions of pupils are not determined from the test results, consequently the pupils have no fear of the tests. The whole testing program is mentally hygienic for both pupils and teachers. There are no incentives on the part of the teacher to prepare the pupils for the test or to falsify the results. Tests are looked upon as part of the instructional program and not something apart from the regular school work. The teachers are familiar with the methods of administering and scoring the tests, also reporting the results. The whole set-up is conducive of valid and reliable results.

Grades four to six have been selected for study because of the well organized and regular testing programs in these grades, and also because in these non-departmentalized grades the pupils remain with one teacher for a term. As a consequence any changes in pupil behavior due to teacher-influence may be ascribed to the influence of one individual teacher.

To determine the growth of pupils in reading and vocabulary, tests prepared by Dr. Donald D. Durrell and Miss Helen B. Sullivan, and published by the World Book Company, have been used.[1/] The published norms are practically the same as those established by Providence pupils and as a consequence the tests are popular with both pupils and

1/ Donald D. Durrell, and Helen Blair Sullivan, Reading Achievement Test. World Book Company, Yonkers-on-Hudson, New York.

teachers.

The Stanford Achievement Tests in Arithmetic Reasoning and Arithmetic Fundamentals have been used to measure the pupil-growth in arithmetic.[1] These tests have been prepared by Dr. Truman L. Kelley, Dr. Giles M. Ruch, and Dr. Lewis M. Terman. The norms for these tests are based on the performance of those pupils who are at grade for their age. Providence pupils are a little below these modal norms. This condition may be due to the fact that the modal-age groups represent a superior selection of pupils in relation to the total grade population. The equated scores are used in the study. Form D was used for the initial test and Form E was used in the final program.

Additional data such as chronological age, school grade, mental ability as measured by the Pintner General Ability Test[2] and socio-economic status as measured by the Sims Score Card[3] are used in this study.

Teacher examinations.— The teacher examinations studied in the investigation are not the National Teacher Examinations. The National tests were not developed until 1940. In Providence, due to a sharp decline in the school population and the consequent closing of small buildings and the combining of rooms in the larger buildings, but few

1/ Truman L. Kelley, Giles M. Ruch, and Lewis M. Terman, Stanford Achievement Test. World Book Company, Yonkers-on-Hudson, New York.

2/ Rudolf Pintner, Pintner General Ability Test. World Book Company, Yonkers-on-Hudson, New York.

3/ Sims Score Card for Socio-Economic Status, Form C. Public School Publishing Company, Bloomington, Illinois.

appointments have been made since 1940. Therefore it will not be possible to study a group of teachers who were subjected to the National Teacher Examinations until a few years hence.

Between the years 1932 and 1940 the Cooperative and American Council examinations were used for teacher examinations in Providence. The general examinations consisted of a psychological or scholastic aptitude test, a test of professional information, and a general culture test. These examinations are prepared by qualified experts in their respective fields. They are very similar to the general examinations of the National tests. In fact, the National Teacher Testing Program was patterned after the Providence plan of testing teachers. Dr. Ben D. Wood, Director of the Cooperative Test Service, states that an inspection of the National and Cooperative tests "reveals such substantial similarities" that the "results of research on the Cooperative and American Council Tests will be quite applicable to the corresponding parts of the National Teacher Examinations."

Data on the teachers consist of scores in scholastic aptitude (American Council Psychological Test), professional information (Cooperative test), and general culture (Cooperative test).

The selection of teachers for the experiment.— All teachers in grades four to six who had taken the teacher examinations, and this means all who had been appointed after 1933 and were teaching in these grades, were selected to take part in this experiment. A few extra teachers were included to mislead any suspicions that the younger teachers were being studied. Meetings were held with this group and

the project was discussed. The group was told that tests were being studied, not the pupils or the teachers. No one had cause to be anxious about the results. The teachers were asked, however, to motivate the pupils to do their best work and to be fair to the tests. Two tests were to be used, the Durrell-Sullivan Reading Achievement Test and the Stanford Achievement Test in Arithmetic. Two programs were to be held, an initial testing program in September and a final program at the end of the term in January.

The teachers' part in the testing program.-- The teachers' duties were to administer the tests, score them, and report the results in the form of distributions. A record sheet was prepared by each teacher on which were listed the names of the pupils arranged in alphabetical order, with ages, grade, and a record of the scores obtained on the tests. This was the same procedure followed each year in all testing programs.

At the close of the term, in January, the testing program was repeated and the same procedure followed. No distribution sheets were prepared in the final program as no norms were required.

Psychological tests.-- Pupils in the Providence schools are measured with a group mental test every three years. The tests are planned for grades one, three, six, nine, and twelve. They are administered by three psychological examiners assisted by a few teachers who have been selected and trained for the work and whose administration is supervised by a regular examiner. Since most of the pupils in this study had not been tested since they were in grade three, it was decided to

retest all of the pupils. The Pintner General Ability Test was administered and the raw scores were used in the study.

Period allowed for growth.— The period considered in which to observe growth was one term, or five months. It may be true that a period of such length is too short a time in which to observe growth. The school organization in Providence is such, with its semi-annual promotions, that in some buildings the pupils remain only five months with one teacher. This factor necessitated the choosing of this short period for the observation of growth in achievement.

The testing program.-- The initial testing program offered no problems as it was part of the regular school work. The school administrators gave their assistance by calling meetings, addressing the teachers, and sponsoring the many notices and directions that were sent out to the schools.

Scores on the teacher examinations.-- The distributions of scores on the teacher examinations had a wide spread. This condition was due to the fact that the list carried candidates for shop positions who, although specialists in certain types of work, had never attended school beyond the secondary grades; also art and music candidates whose preparation had been quite specialized; as well as graduates of the teachers' and liberal arts colleges. All raw scores were reduced to percentile scores. The scores of the teachers participating in the experiment ranged from 10 to 90 in each of the common examinations. It would seem that candidates with low ratings would not have been selected for positions. They were appointed, however, at a time when

teachers were more or less scarce. Since only local candidates are approved by the School Committee, these candidates were successful in receiving appointments because they were local residents.

Scores on socio-economic status.— The relationship between socio-economic status and school achievement has been shown to be significant by Kornhauser,[1] Holley,[2] and Collins and Douglass,[3] as well as many others. Kornhauser and Holley found relationship between retardation, years spent in school, and an index of socio-economic status. Studies made by Collins and Douglass showed significant relationship between school success in the junior high school and the socio-economic status of the home. Much has been written on the subject of the influence of nature and nurture on intelligence.

Scores on socio-economic status.— Scores on socio-economic status were obtained for all pupils taking part in the study. Such scores depend on the census tracts in which the families live and the results of a test which measures socio-economic status.

Census tracts[4].— The city of Providence is divided into forty-nine sections or census tracts. These tracts are small areas which

1/ A. W. Kornhauser, "The Economic Standing of Parents and the Intelligence of Their Children," Journal of Educational Psychology, 1918, 9: 159-164.

2/ C. E. Holley, "The Relationship Between Persistence in School and Home Conditions," National Society for the Study of Education Yearbook, 1916, 15: Part II.

3/ J. H. Collins, and H. R. Douglass, "The Socio-Economic Status of the Home As A Factor in Success in the Junior High School," Elementary School Journal, 1937, 38: 107-113.

4/ Population and Housing in Providence, Rhode Island, 16th Census of the United States, U. S. Government Printing Office, Washington, D. C., 1940.

have a population of approximately five thousand people. They are set off for statistical purposes. While the divisions are more or less arbitrary, certain principles have been followed in laying them out. Approximate uniformity in population and uniformity in area size are considerations in the establishment of these tracts.

In dividing the city, consideration has been given to natural and other boundaries such as highways, railroads, parks, and rivers. Each tract is designed to include an area that is fairly homogeneous. The tracts are intended to remain unchanged from census to census. Such a plan makes possible a study of movements in population, changes in housing conditions, and statistics in crime, births, deaths, sickness, unemployment, relief, etc.

The School Department studies these tracts in regard to problems of truancy and juvenile delinquency. Each tract has a certain socio-economic rating which was determined by means of the Sims Score Card. The tracts are registered with the State and the United States census. The map which follows gives the distribution of the different tracts and the location of the sixteen different schools represented in the study.

Obtaining a score for the census tracts.— The Sims questionnaire was administered to 2,387 seventh grade pupils in the same year that the pupils in grades four to six were tested for the experiment. Since the children in Rhode Island cannot leave school until their sixteenth birthday and since most pupils reach grade seven before this age, it seemed fitting to conclude that a measure of all 7B pu-

pils would furnish a suitable index of social status that might be applied to pupils in grades four to six. The results of the test were distributed and percentile scores were established for the test scores.

Another distribution was made of these 7B pupils according to the census tract in which they lived and the scores the pupils obtained on the Sims test. The mean score on the Sims test was determined for each tract. This mean score was translated into the percentile rating established by the Sims test. Each pupil was then given a socio-economic percentile score according to the location of his home. An illustration of the functioning of this procedure follows.

Example:

Step 1. A socio-economic score: Raymond G., in grade 4A, lives at 253 Thurber Avenue. This address is located in Census Tract 9. The mean score for Tract 9, which was established by the pupils living in Tract 9 who took the Sims Test, is 14. A score of 14 is equal to a percentile rating of 63. Raymond G. is rated 63, or C+, in regard to socio-economic status. (See Distribution Sheets, Curve, and Sample Sheet on Socio-Economic Status)

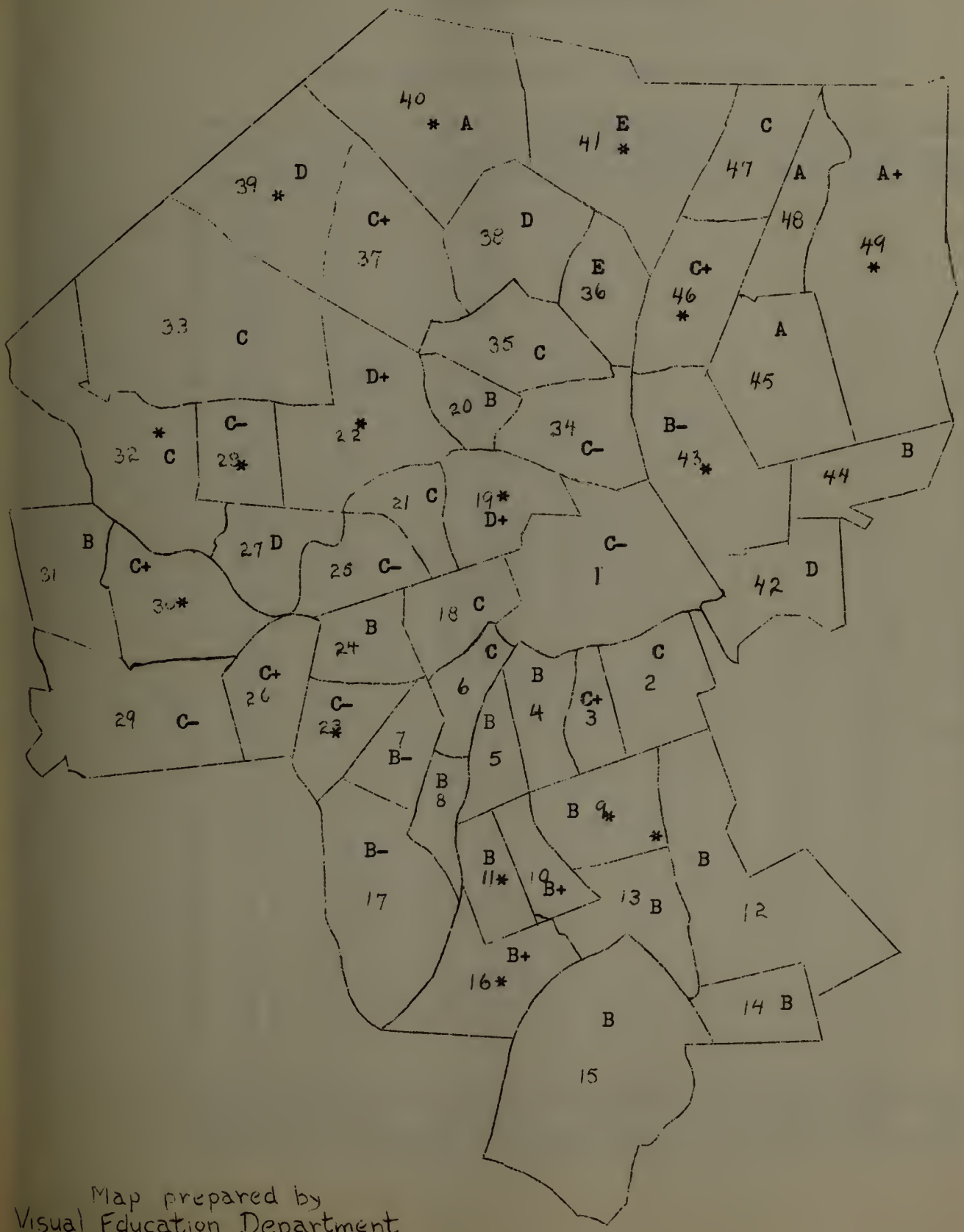
Step 2. A mean socio-economic score: A teacher, Miss B., has twenty pupils in her group. The pupils' various socio-economic ratings, depending on the location of their homes, average 49.95. The rating which is given to Miss B. for her group in regard to environment and background is 49.95.

A list of the census tracts with the median scores from the Sims Score Card together with the percentile ratings assigned to each tract

is found in Table 1. Following is the map showing the location of the forty-nine census tracts of Providence.

Map Showing the Location of the Forty-nine Census Tracts of Providence

The socio-economic status of each tract is indicated by a letter rating. Stars indicate the location of the sixteen schools represented in this investigation.



Map prepared by
Visual Education Department

DISTRIBUTION OF SCORES ON SIMS SCORE CARD

ACCORDING TO CENSUS TRACTS

Sims Score Card, Form C--Grade 7B--1942

Score	Census Tracts									
	1	2	3	4	5	6	7	8	9	10
36										
35										
34										
33										
32										
31										
30										
29										
28										
27										1
26				1				1	1	
25									2	1
24			1	1	2			1		2
23				1	1				1	
22	1		2	2	1		1		1	4
21				1				1	2	1
20	2		1	6	2		3	2	6	3
19	1		1				2		1	1
18			2				2	1	4	5
17		1		2	2	2	2	1		(1)
16	1	1	8	3	(2)	4	3		12	3
15	1						2		3	
14	8		5	7		3	(3)	1	(9)	10
13			2		1	2	1	1	2	
12	5	2	(4)	(9)	4	6	3	(5)	11	2
11			2			(2)				
10	3	4	3	3	3	5	6	1	6	3
9	(4)	(1)	1	3		1		1	3	
8	9	3	8	4		2	7	1	6	
7	2		1	1		2				
6	4	2	5	8		3		2	2	
5		1							1	
4	4	1	2	2		2			4	
3		1	1			1				
2			1							
1										
0										
Total	45	17	50	54	18	35	35	19	77	37

| | | |

DISTRIBUTION OF SCORES ON SIMS SCORE CARD

ACCORDING TO CENSUS TRACTS

Sims Score Card, Form C--Grade 7B--1942

Score	Census Tracts									
	11	12	13	14	15	16	17	18	19	20
36										
35										
34										
33										
32										1
31										
30				1						
29					1					
28	1									
27						1				
26	1	1	1	2	1	1				
25			1			1		1		
24	2		2		2					
23	2					1	1			
22	2			4	1	4	1		1	
21							1	1		
20	2	5	3	6	5	5	2	2		5
19		2	1		1	(2)		1	1	1
18	1	2	3	(4)	(6)	1	1		2	1
17	2	1	2	2		1	2	1		
16	(1)		(6)	4	4	3	6	1	1	2
15	2	1		2	1	2	(5)	2	3	
14	3	2	3	4	3		4	12	2	2
13	1	1	1			2		5	3	
12	4	(2)	7	1	3	3	5	(13)	4	4
11		1					1		5	
10	2	4	5	2	1	1	1	14	11	(5)
9							1		5	1
8	1	5	2				2	4	(21)	3
7		1						1	4	
6		5					1	11	22	3
5								3	4	
4								3	13	4
3									5	
2								1	9	1
1										
0									1	
Total	27	33	37	32	29	28	34	76	117	33

| | | |

DISTRIBUTION OF SCORES ON SIMS SCORE CARD

ACCORDING TO CENSUS TRACTS

Sims Score Card, Form C--Grade 7B--1942

Score	Census Tracts									
	21	22	23	24	25	26	27	28	29	30
36										
35										
34										
33										
32										
31										
30										
29										
28										
27		1								
26							1			
25						1				
24		1					1			
23		1								
22								1	2	
21		1	1						1	1
20		1	1		2	1	1	1	4	2
19	1	1				2				
18		1	1	5					4	1
17				3		2	1			1
16	4	3	2	3	2	5		3	3	3
15	1	1				5	1		2	1
14	4	2	5	4	3	6	2	5	8	4
13	2				2	2			5	2
12	8	5	5	7	13	(6)	7	1	11	(6)
11	3	1	2		1	1	2	1	5	1
10	12	10	(8)	(8)	14	7	5	(6)	16	3
9	2	1	3	1	6	4	2	4	8	1
8	10	(11)	4	5	(8)	3	(9)	3	(23)	8
7		5	1	1	4	1	2	1	8	
6	13	8	3	8	13	3	6	3	18	2
5	2	1	1	1	8		3		3	1
4	6	5	4	3	7	1	13	1	11	1
3		1		1	5		2		2	
2	1	2	1	2	3	1	3		6	
1	1	2			1					
0					2					
Total	70	65	42	52	94	51	61	30	140	38

| | | |

DISTRIBUTION OF SCORES ON SIMS SCORE CARD

ACCORDING TO CENSUS TRACTS

Sims Score Card, Form C--Grade 7B--1942

Score	Census Tracts									
	31	32	33	34	35	36	37	38	39	40
36										
35										
34										
33										
32										
31										
30										
29										
28										
27										
26										
25									1	
24			1					1	1	
23							1		1	1
22	1	1	3	1			3		3	1
21	1				1					
20	1		3		2		5	1	2	
19		1	1				1	1		
18		2	5	1	1		3		2	2
17	1		1		1		2	1		
16	3	8	12		7		6	4	5	
15		1			2			1		
14	3	3	(5)	2	2	3	6	4	4	2
13					3	1	4		3	
12	(4)	6	8	1	7	3	4	8	4	6
11	1	5	1		1				5	
10	3	(11)	8	(2)	(15)	4	(10)	(11)	(4)	(8)
9	1		1		4		1	4	1	
8	5	11	7	3	7	4	5	8	3	6
7		1			2		3	5	6	
6	1	3	1	3	8	(5)	8	4	9	4
5		3	1		3	2	1	3	3	
4	2	2	1		12	1	3	3	4	2
3		1			1	6	2	1	4	
2			1		3	3	2	1	2	1
1					1	1	2		1	
0							1	1	1	
Total	27	59	60	13	83	33	73	62	68	33

DISTRIBUTION OF SCORES ON SIMS SCORE CARD

ACCORDING TO CENSUS TRACTS

Sims Score Card, Form C--Grade 7B--1942

Score	Census Tracts									Total
	41	42	43	44	45	46	47	48	49	
36					1					1
35			1							1
34					1					1
33										
32					5					6
31										
30			1		6	1		5	3	17
29			1					1		3
28				3	(6)		2	2	5	19
27							1	2		6
26			2		2	1	3	4	(4)	27
25		1				2		1		12
24				1	2	8	3	(5)		37
23					1	2	1	1		16
22			4		6	4	9()	3	4	71
21				1		1	1()	1		17
20		2	1	1	1	5	1	1	1	100
19		1				3	1	2		30
18	1	1		(1)	3	6	4	1	2	82
17			1()			1	1			38
16	1	5	2()		1	11	3	1		162
15		1	1			(1)				42
14	5	4	1	2		6	2			178
13						5		1		52
12	13	5	2	1		13				(251)
11	1	1			1	1	1			46
10	10	12	2	2		5	2			281
9		4		1		3			1	74
8	5	(9)				4	2			241
7	(1)	1				1	1			55
6	10	7				4				212
5	4	7				1				57
4	6	4	2							129
3	8	2								44
2	4	4	1							53
1	4	3				1				17
0		2				1				9
Total	73	76	22	13	36	91	38	31	20	2387

Percentile Distribution Sheet

Providence Public Schools
Department of Research & Guidance

Test Sims Score Card Form C

Date 1942

Test Scores	Grades 7B	
36	1	47
34–35	2	47
32–33	6	47
30–31	17	47
28–29	22	47
26–27	33	46
24–25	49	46
22–23	87	45
20–21	117	43
18–19	112	41
16–17	200	38
14–15	220	34
12–13	303	30
10–11	327	24
8–9	315	17
6–7	267	11
4–5	186	6
2–3	97	2
0–1	26	
TOTALS		

Total number 2387 Grades 7B

Percentile Graph

Score	Percentile According to Curve
36	99
35	99
34	99
33	98
32	98
31	98
30	98
29	98
28	98
27	97
26	97
25	96
24	95
23	93
22	92
21	88
20	86
19	84
18	80
17	77
16	73
15	68
14	63
13	56
12	50
11	42
10	34
9	29
8	22
7	16
6	12
5	8
4	5
3	3
2	1
1	0
0	0

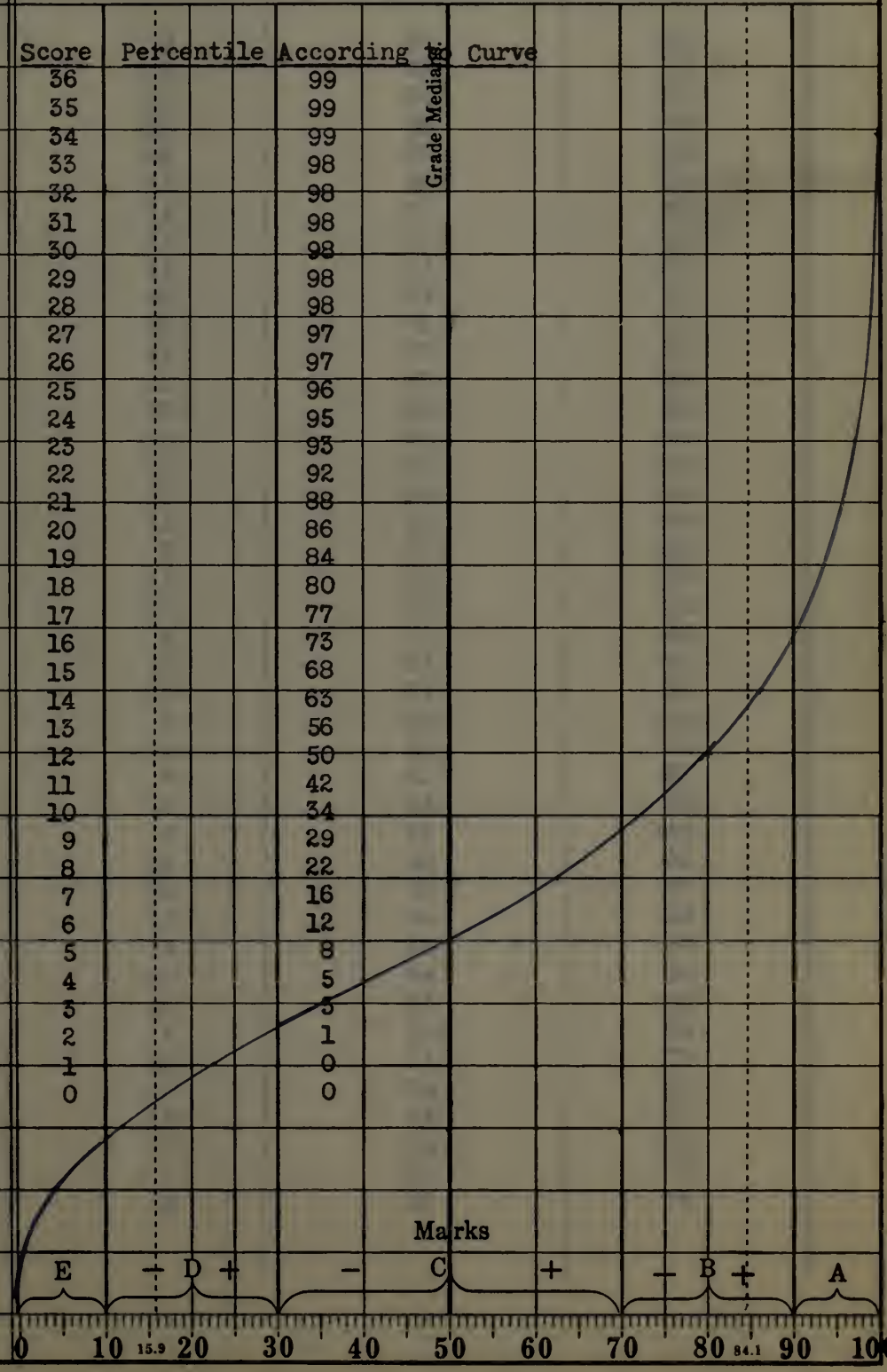


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Table 1. List of Census Tracts with Median Scores from the Sims Score Card and Percentile Ratings Assigned to Each Census Tract.

Census Tract	Median Score on Sims Score Card	Percentile Rating of Median Score of Each Tract	No. of Cases
1	9	29	45
2	9	29	17
3	12	50	50
4	12	50	54
5	16	73	18
6	11	42	35
7	14	63	35
8	12	50	19
9	14	63	77
10	17	77	37
11	16	73	27
12	12	50	33
13	16	73	37
14	18	80	32
15	18	80	29
16	19	84	28
17	15	68	34
18	12	50	76
19	8	22	117
20	10	34	33
21	10	34	70
22	8	22	65
23	10	34	42
24	10	34	52
25	8	22	94
26	12	50	51
27	8	22	61
28	10	34	30
29	8	22	140
30	12	50	38
31	12	50	27
32	10	34	59
33	14	63	60
34	10	34	13
35	10	34	83
36	6	12	33
37	10	34	73
38	10	34	62
39	10	34	68
40	10	34	33
41	7	16	73
42	8	22	76

Table 1. (concluded)

Census Tract	Median Score on Sims Score Card	Percentile Rating of Median Score of Each Tract	No. of Cases
43	17	77	22
44	18	80	13
45	28	98	36
46	15	68	91
47	22	92	38
48	24	95	31
49	26	97	20
Total Number of Cases			2387

SAMPLE SHEET: PUPILS OF TEACHER #1

Addresses, Census Tracts, and Sims' Percentile Ratings

Oxford Street School Miss B. Grades 4A, 5B

Name	Address	Census Tract	Percentile Rating of Census Tract According to Sims Test
1. G., R.	253 Thurber Avenue	9	63
2. S., E.	9 Salisbury Street	9	63
3. S., G.	103 Thurber Avenue	12	50
4. S., W.	99 Miner Street	9	63
5. S., R.	54 Seymour Street	12	50
6. S., W.	127 Oxford Street	9	63
7. T., A.	73 Bishop Street	2	29
8. W., D.	961 Eddy Street	9	63
9. Y., O.	237 Rhodes Street	2	29
10. F., M.	160 Blackstone Street	2	29
11. G., M.	985 Eddy Street	9	63
12. S., A.	68 Miner Street	9	63
13. S., R.	56 Gay Street	3	50
14. M., J.	243 Rhodes Street	2	29
15. F., I.	68 Oxford Street	12	50
16. G., J.	97 Staniford Street	3	50
17. M., C.	103 Thurber Avenue	12	50
18. M., Q.	1061 Eddy Street	12	50
19. S., B.	86 Colfax Street	9	63
20. T., L.	125 Blackstone Street	2	29
Mean Socio-Economic Score			49.95

Item	Description	Quantity	Amount
1.	[illegible]	1	[illegible]
2.	[illegible]	1	[illegible]
3.	[illegible]	12	[illegible]
4.	[illegible]	1	[illegible]
5.	[illegible]	24	[illegible]
6.	[illegible]	1	[illegible]
7.	[illegible]	1	[illegible]
8.	[illegible]	1	[illegible]
9.	[illegible]	1	[illegible]
10.	[illegible]	1	[illegible]
11.	[illegible]	1	[illegible]
12.	[illegible]	1	[illegible]
13.	[illegible]	1	[illegible]
14.	[illegible]	1	[illegible]
15.	[illegible]	1	[illegible]
16.	[illegible]	12	[illegible]
17.	[illegible]	1	[illegible]
18.	[illegible]	1	[illegible]
19.	[illegible]	1	[illegible]
20.	[illegible]	1	[illegible]
	[illegible]		[illegible]

PART TWO

PRESENTATION OF STATISTICAL DATA

CHAPTER V

PROCEDURES FOLLOWED IN THE INVESTIGATION

Major Steps in the Statistical Procedure

Although the purpose of this study and the materials used have been described in a previous chapter, at the risk of some repetition the major steps of the procedure followed are summarized below.

Measurement of Pupils and Teachers.-- The measurement of the pupils to be studied in the belief that a teacher's success is proportional to the changes engendered in her pupils and also with the view that certain desirable changes in the pupils can be measured by standardized tests.[1/]

1. The Achievement Testing Program
    a) Initial testing program, September, 1942
    b) Final testing program, January, 1943
2. Group Intelligence Test Administered
    a) Pintner General Ability Test
3. Grades Tested
    a) Grades 4B, 4A, 5B, 5A, 6B
4. Number of Teachers and Pupils in the Experiment
    a) 37 teachers, appointed between 1933 and 1939
    b) 1162 pupils tested and instructed
    c) 740 pupils selected for a detailed study

1/ W. S. Connor, "New Method of Rating Teachers," Journal of Educational Research, 1920.

5. Tests Used, Subjects Tested

a) Durrell-Sullivan Reading Test

b) Durrell-Sullivan Vocabulary Test

c) Stanford Achievement Tests

1) Arithmetic Reasoning

2) Arithmetic Fundamentals

Statistical Treatment of the Data.--

1. Individual pupil growth scores computed in each subject tested. (Difference between raw score on initial test and that on the final test.)

2. Mean growth score determined for each group in each subject.

3. Mean score computed for each group in the four independent variables considered in the experiment. (Chronological age, intelligence, grade, and socio-economic status.)

4. Multiple regression equations prepared with five variables. (Dr. Truman L. Kelley's method followed.)

5. A mean score predicted or estimated for each group in each subject by means of multiple regression equations.

6. A comparison of the predicted mean scores and the actual or observed mean scores in each subject tested. The difference between these two scores is called the teacher-influence score.

7. Computation of such statistics as multiple R, the standard error of estimate, the significance of the b coefficients, and the zero-order correlations.

8. Computation of zero-order coefficients of correlation obtained between teacher-influence scores and scores on the teacher examinations in scholastic aptitude, professional information, and general culture.

CHAPTER VI

STATISTICAL TREATMENT OF THE DATA AS IT PERTAINS TO READING COMPREHENSION

The Extent to Which Growth in Reading Comprehension in Grades 4-6 is Determined by the Combined Action of the Chronological Age, Intelligence, Grade, and Socio-Economic Status of the Pupils

The Multiple Regression Equation.-- After the necessary raw data on the pupils and teachers have been gathered, the next important step in the procedure is to predict a mean growth score of pupil achievement in reading comprehension in each of the thirty-seven groups represented in the experiment. This growth in reading is measured over a period of five months. The prediction is based on the combined influence of the pupil's chronological age, intelligence, grade, and socio-economic status.

The method chosen for the solution of this problem calls for a multiple regression equation that involves the five variables mentioned above, reading being the dependent variable while chronological age, intelligence, grade, and socio-economic status are the independent variables. These particular variables have been chosen for study because of their possible importance in regard to school achievement and again because they are objective and can be measured. The variables are designated as X_0, reading; X_1, chronological age; X_2, intelligence; X_3, grade; and X_4, socio-economic status. Since there are more than three variables the solution of the regression equation and a multiple R has been computed by means of the Truman L. Kelley method which organizes the work

in such a way that the calculation is comparatively easy.

Data necessary for the multiple regression equation.— The following data are required for the multiple-correlation solution:

1. The mean of each of the variables being studied
2. The sigmas of the variables
3. The covariances of the variables.

To obtain the covariances of the variables it is necessary to compute the simple correlations between the variables. These values are listed in Tables 2 and 3.

Partial regression coefficients.— The b, or partial regression coefficients, are developed by means of the multiple correlation table and these give the net weight assigned to the independent variables. From the multiple correlation table these weights can be read: $b_{01.234} = -.3605$, the net weight assigned to X_1 (chronological age) in predicting X_0 (reading) when the effects of X_2, X_3, and X_4 (intelligence, grade or year of school work, and socio-economic status) are held constant. $b_{02.134} = .1019$, the net weight assigned to X_2 (intelligence) in predicting X_0 (reading) when the effects of X_1, X_3, and X_4 (chronological age, grade or year of school, and socio-economic status) are held constant. $b_{03.124} = .7998$, the net weight assigned to X_3 (grade or year in school) is interpreted similarly, and $b_{04.123} = .0032$, furnishes the net weight assigned to X_4 (socio-economic status).

The multiple regression equation.— Having calculated the value of the b coefficients it is now possible to write the regression equation that involves the four independent variables. From the equation, an

Data Required for the Multiple Regression Equation in the Study of Growth in Reading Comprehension

Table 2. Means, Variances, and Sigmas of the Variables.

	Chron. Age	Intelligence	Grade	Socio-Econ.	Reading
Mean	10.4331	132.5943	4.9811	42.8110	4.3933
Variance	.9332	133.0216	.3365	461.8631	25.0340
Sigma	.9660	11.5335	.5801	21.4910	5.0034

Table 3. Variances and Covariances of the Several Variables in the Study of Reading Comprehension.

	Chron. Age	Intelligence	Grade	Socio-Econ.	Reading
Chron. Age	.9332	.8880	.3402	-1.9888	.0198*
Intell.		133.0216	3.5587	75.2522	16.3252*
Grade			.3365	.6844	.5117*
Socio-Econ.				461.8631	10.4302*
Reading					25.0340

*Signs are changed when used in the multiple correlation table.

Table 4. Multiple Correlation Table With Five Variables, Reading Comprehension the Dependent Variable.

Row	Div. or Mult.	X_1	X_2	X_3	X_4	X_0	Col. 1	Col. 2	Col. 3	Col. 4	Check Col.
1		V_1 .9332	.8880	.3402	-1.9888	-.0198	-1.				.1528
1′ R_1 ÷	-.9332	-1.	(-.9516)	(-.3646)	(2.1312)	(.0212)	1.0716				
20			V_2 133.0216	3.5587	75.2522	-16.3252	0	-1.			196.3953
21 R_1 x	-.9516		-.8450	-.3237	1.8925	.0188	.9516				-.1454
2 Sum			132.1766	3.2350	77.1447	-16.3064	.9516	-1.			196.2499
2′ R_2 ÷	-132.1766		-1.	(-.0245)	(-.5836)	(.1234)	.0072	.0076			196.2499
30				V_3 .3365	.6844	-.5117	0	0	-1.		4.4081
31 R_1 x	-.3646			-.1240	.7251	.0072	.3646				-.0557
32 R_2 x	-.0245			-.0793	-1.8900	.3995	-.0233	.0245			-4.8081
3 Sum				.1332	-.4805	-.1050	.3413	.0245	-1		-.4557
3′ R_3 ÷	-.1332			-1.	(3.6074)	(.7883)	-2.5623	-.1839	7.5075		-.4523
40					V_4 461.8631	-10.4302	0	0	0	-1.	525.3807
41 R_1 x	2.1312				-4.2385	-.0422	-2.1312				.3256
42 R_2 x	-.5836				-45.0216	9.5164	-.5554	.5836			-144.5314
43 R_3 x	3.6074				-1.7334	-.3788	1.2312	.0884	-3.6074		-1.6439
4 Sum					410.8696	-1.3348	-1.4554	.6720	-3.6074	-1.	409.5310
4′ R_4 ÷	-410.8696				-1.	(.0032)	.0035	-.0016	.0088	.0024	409.5344
00						V_0 25.0340	0	0	0	0	-2.2529
01 R_1 x	.0212					-.0004	-.0212				.0032
02 R_2 x	.1234					-2.0122	.1174	-.1234			24.2172
03 R_3 x	.7883					-.0828	.2690	.0193	-.7883		-.3502
04 R_4 x	.0032					-.0043	-.0047	.0022	-.0115	-.0032	1.3105
0 Sum						$V_{0.1234}$ 22.9343	b_{01}.3605	b_{02}.1019	b_{03}.7998	b_{04}.0032	22.9188
0′ R_0 ÷	-22.9343					-1.	-.0157	.0044	.0349	.0001	22.9343
1x1′							-1.0716				
2x2′							-.0069	-.0076			
3x3′							-.8745	-.0045	-7.5075		
4x4′							-.0051	-.0011	-.0317	-.0024	
0x0′ A							-.0057	-.0004	-.0279	-.00000032	
Sum B							-1.9638	-.0136	-7.5671	-.0024	
r^2 A/B						$r^2_{01.234}$	.0059	r^2_{02}.0294	r^2_{03}.0037	r^2_{04}.0001	

Regression Equation $X_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 + [4.3933 - (-.3605 \times 10.4331) - (.1019 \times 132.5945) - (.7998 \times 4.9811) - (.0032 \times 42.8110$

$$X_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 - 9.4779$$

Table 4. (concluded)

X_0 = Reading Comprehension

X_1 = Chronological Age

X_2 = Intelligence

X_3 = Grade

X_4 = Socio-Economic Status

A check on the b coefficients:

$-b_{01.234} = .3605 \qquad .3605 \times .9332\ (V_1) = .3364$

$-b_{02.134} = -.0119 \qquad -.0119 \times .8880\ (CV_{12}) = -.0905$

$-b_{03.124} = -.7998 \qquad -.7998 \times .3402\ (CV_{13}) = -.2721$

$-b_{04.123} = -.0032 \qquad -.0032 \times -1.9888\ (CV_{14}) = -.0064$

$\text{Sum} = -.0196\ (CV_{01})$

Values of Variances (Used in testing significance of b coefficients)

$V_{1.0234} = -1 \div -1.9638 = .5092$

$V_{2.0134} = -1 \div -.0136 = 73.5294$

$V_{3.0124} = -1 \div -7.5671 = .1322$

$V_{4.0123} = -1 \div -.0024 = 416.6667$

Values of r^2 (Used in testing significance of b coefficients)

$r^2_{01.234} = .0059$

$r^2_{02.134} = .0294$

$r^2_{03.124} = .0037$

$r^2_{04.123} = .0001$

X_0 score (mean reading score) is predicted for each of the thirty-seven teachers. The general form of the regression equation is:

$$\bar{X}_0 = b_{01.234}X_1 + b_{02.134}X_2 + b_{03.124}X_3 + b_{04.123}X_4 + C$$

Inserting the numerical values of the b coefficients, which were developed in the multiple correlation table, the equation reads:

$$\bar{X}_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 + C$$

The only quantity lacking for the complete multiple regression equation is the constant C. This is computed from the general equation:

$$C = M_0 - b_{01.234}M_1 - b_{02.134}M_2 - b_{03.124}M_3 - b_{04.123}M_4$$

in which M_0, M_1, M_2, M_3, and M_4 are respectively the mean values of the several variables being studied. Expressed numerically the equation for C reads:

$C=4.3933-(-.3605x10.4331)-(.1019x132.5945)-(.7998x4.9811)-(.0032x42.8110)$

$C = -9.4779$

The regression equation now reads:

$$\bar{X}_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 - 9.4779$$

Given the mean chronological age of a group of pupils (X_1), the mean score on the Pintner test (X_2), the mean grade for the group of pupils (X_3), and the mean socio-economic status score (X_4), the next step is to predict the most probable mean score in reading for each group of pupils. Following, in Table 5, are the values used in the computations for predicted growth for each group in reading comprehension.

Table 5. Regression Equation Values for Reading Comprehension As Applied to Each Teacher or Group.

Teacher	X_1 Chron. Age		X_2 Intelligence		X_3 Grade, Year of Sch.		X_4 Soc.-Ec. Stat.		Constant	Estim. Growth
	Weight	Mean Score	Weight	Mean Score	Weight	Mean Score	Weight	Mean Score		
# 1	-.3605x	10.	+.1019x	129.0	+.7998x	4.675	+.0032x	49.95	-9.4779	3.9611
# 2	-.3605x	9.4	+.1019x	128.5	+.7998x	4.1	+.0032x	34.	-9.4779	3.6156
# 3	-.3605x	9.83	+.1019x	136.7	+.7998x	4.9	+.0032x	34.	-9.4779	4.9359
# 4	-.3605x	10.35	+.1019x	130.85	+.7998x	4.5	+.0032x	34.15	-9.4779	3.8329
# 5	-.3605x	10.5	+.1019x	135.0	+.7998x	5.0	+.0032x	43.0	-9.4779	4.6299
# 6	-.3605x	10.15	+.1019x	125.65	+.7998x	4.5	+.0032x	52.3	-9.4779	3.4332
# 7	-.3605x	10.68	+.1019x	139.9	+.7998x	5.25	+.0032x	26.1	-9.4779	5.2103
# 8	-.3605x	10.54	+.1019x	129.3	+.7998x	4.7	+.0032x	53.95	-9.4779	3.8299
# 9	-.3605x	11.22	+.1019x	136.4	+.7998x	5.325	+.0032x	48.4	-9.4779	4.7903
#10	-.3605x	10.22	+.1019x	127.9	+.7998x	4.5	+.0032x	27.7	-9.4779	3.5636
#11	-.3605x	10.44	+.1019x	127.45	+.7998x	4.825	+.0032x	26.2	-9.4779	3.6885
#12	-.3605x	10.33	+.1019x	132.45	+.7998x	4.675	+.0032x	41.4	-9.4779	4.1664
#13	-.3605x	12.095	+.1019x	139.9	+.7998x	5.675	+.0032x	22.7	-9.4779	5.0292
#14	-.3605x	10.95	+.1019x	137.1	+.7998x	5.0	+.0032x	52.15	-9.4779	4.7110
#15	-.3605x	10.53	+.1019x	138.1	+.7998x	5.0	+.0032x	34.4	-9.4779	4.9075
#16	-.3605x	10.77	+.1019x	136.3	+.7998x	5.0	+.0032x	22.7	-9.4779	4.6001
#17	-.3605x	9.77	+.1019x	119.3	+.7998x	4.0	+.0032x	29.4	-9.4779	2.4500
#18	-.3605x	9.62	+.1019x	121.35	+.7998x	4.0	+.0032x	30.2	-9.4779	2.7155
#19	-.3605x	10.32	+.1019x	144.3	+.7998x	5.325	+.0032x	49.35	-9.4779	5.9227
#20	-.3605x	10.79	+.1019x	129.75	+.7998x	4.725	+.0032x	24.75	-9.4779	3.7122
#21	-.3605x	9.93	+.1019x	120.2	+.7998x	4.0	+.0032x	28.4	-9.4779	2.4808
#22	-.3605x	9.31	+.1019x	130.05	+.7998x	4.05	+.0032x	40.65	-9.4779	3.7872
#23	-.3605x	10.42	+.1019x	123.1	+.7998x	4.5	+.0032x	32.00	-9.4779	3.0111
#24	-.3605x	10.53	+.1019x	139.1	+.7998x	5.0	+.0032x	76.15	-9.4779	5.1430
#25	-.3605x	9.4	+.1019x	125.5	+.7998x	4.0	+.0032x	49.7	-9.4779	3.2801
#26	-.3605x	10.31	+.1019x	124.35	+.7998x	4.275	+.0032x	27.8	-9.4779	2.9847
#27	-.3605x	10.85	+.1019x	132.7	+.7998x	5.0	+.0032x	18.7	-9.4779	4.1916
#28	-.3605x	9.98	+.1019x	123.35	+.7998x	4.0	+.0032x	25.45	-9.4779	2.7793
#29	-.3605x	10.42	+.1019x	149.45	+.7998x	5.0	+.0032x	93.8	-9.4779	6.2939
#30	-.3605x	11.47	+.1019x	142.5	+.7998x	5.85	+.0032x	37.4	-9.4779	5.7065
#31	-.3605x	9.77	+.1019x	122.6	+.7998x	4.0	+.0032x	33.8	-9.4779	2.8003
#32	-.3605x	9.92	+.1019x	141.3	+.7998x	4.7	+.0032x	92.55	-9.4779	5.3997
#33	-.3605x	10.22	+.1019x	138.6	+.7998x	4.85	+.0032x	78.4	-9.4779	5.0910
#34	-.3605x	11.72	+.1019x	145.65	+.7998x	6.0	+.0032x	27.85	-9.4779	6.0266
#35	-.3605x	10.92	+.1019x	131.0	+.7998x	5.0	+.0032x	49.95	-9.4779	4.0931
#36	-.3605x	10.9	+.1019x	134.95	+.7998x	5.0	+.0032x	48.9	-9.4779	4.5337
#37	-.3605x	11.7	+.1019x	137.8	+.7998x	6.0	+.0032x	34.6	-9.4779	5.2555

Regression Equation: $\bar{X}_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 - 9.4779$

The use of the regression equation.— Following is an example of the use of the regression equation:

Teacher #1 has been teaching a group of twenty pupils. The data available from this group of pupils are: mean chronological age of the group, ten years; mean score on the Pintner General Ability test, 129; mean grade or school year of the group, 4.675; mean socio-economic score of the pupils, 49.95. Substituting these values in the regression equation it reads:

$\bar{X}_0 = -.3605 \times 10 + .1019 \times 129 + .7998 \times 4.675 + .0032 \times 49.95 - 9.4779$

$\bar{X}_0 = 3.9611$

Using these given criteria as the basis for an estimate or a prediction, the most probable mean score of the growth in reading comprehension for this group of pupils taught by teacher #1 and measured by the Durrell-Sullivan Reading Test is 3.9611.

This same procedure is followed for each teacher participating in the experiment.

The coefficient of multiple correlation (R).— How much we can rely on the predictions from this regression equation is told by the coefficient of multiple R. In other words, we want to know how strong the relationship is between the predicted mean scores estimated by the equation and the observed mean scores determined by the tests. The formula used to obtain R is:

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0}$$

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The values for $V_{0.1234}$ and V_0, the variance between the reading and the combined other variables, and the variance within the reading distribution itself are found in the multiple correlation table, Table 4. Substituting the numerical values, the equation will read:

$$R^2_{0.1234} = 1 - \frac{22.9343}{25.0340} = 1 - .9161 = .0839$$

$$R_{0.1234} = \sqrt{.0839} = .2897$$

To appraise the significance of this R, a variance ratio technique is used. The formula used to test the significance of multiple R is taken from the manuscript of Dr. Truman L. Kelley's new book, "Fundamentals of Statistics,"[1] and is as follows:

$$F_{n,N-n-1} = \frac{\frac{V_{0\Delta 12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}}}{} = \frac{\frac{V_0R^2/n}{\frac{V_0(1-R^2)}{N-n-1}}}{} = \frac{\frac{R^2/n}{\frac{1-R^2}{N-n-1}}}{}$$

Substituting the known numerical values, the equation reads

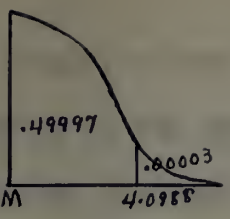
$$F_{4,735} = \frac{.0839/4}{.9161/735} = \frac{.021}{.00125} = 16.8 = t^2 \quad (F = t^2)^{2/}$$

$$t = \sqrt{16.8} = 4.0988$$

From the normal probability curve, 4.0988 is equivalent to an area of .49997 from the mean. The tail area = .50 - .49997 = .00003 = q. 2q (the two tails) have an area of .00006 = p. p = .00006 which is highly significant. There are six chances in 100,000 that the obtained value of R could have arisen by chance.

1/ Truman L. Kelley, Fundamentals of Statistics. Unpublished manuscript.

2/ George W. Snedecor, Statistical Methods. The Iowa State College Press, Ames, Ohio, 1940, p.195.



The interpretation of the coefficient of multiple correlation in terms of the coefficient of multiple determination (R^2).— R^2 measures the proportion of variance in X_0 that is dependent upon or predicted by X_1, X_2, X_3, and X_4 combined. In this section of the study $R^2_{0.1234}$ = .0839 which indicates that 8.39 per cent. of the variance in reading is accounted for by the variances in chronological age, intelligence, grade, and socio-economic status taken together. The remaining 91 per cent. of the variance must be accounted for in some other way.

The interpretation of the coefficient of multiple correlation in terms of the standard error of estimate.— The standard error of estimate has about the same meaning as any other standard error. A probable or estimated mean score in reading has been predicted for each group of pupils. Now if the correlation between the estimated and the observed scores were perfect, one would find on charting these mean scores that all the estimated score would lie on the regression line. Since the correlation is not perfect the scores are scattered all along the line, some above, some below, and a few probably on the line. For each mean score that is charted and does not fall on the regression line there is a certain distance between the charted score and the line. These distances may vary with each mean score. These distances from the regression line may be called residuals, or residual errors,

or errors of estimate.[1] The R, or the coefficient of multiple correlation, furnishes a measure of the amount of these errors present in the scores which are estimated from the other combined variables. The standard deviation of these errors is called the standard error of estimate.

The formula used to discover the standard error of estimate is

$$\sigma_{0.1234} = \sigma_0\sqrt{1-R^2_{0.1234}}$$

Substituting the numerical vales which have been found in this study the formula reads

$$\sigma_{0.1234} = 5.0034\sqrt{1-.2897}$$

$$\sigma_{0.1234} = 4.2164$$

This means that two-thirds of the predicted reading values will be within 4.2 points of the obtained reading values.

The reliability of the b coefficients.-- The b coefficients are subject to errors also. Their reliability can be discovered by using the following formula which is taken from the manuscript of Dr. Truman L. Kelley's new book.[2]

$$F_{1(N-n-1)} = \frac{\left[b_{01.2\ldots)i(\ldots\bar{n}-\tilde{b}}\right]^2\left[V_{i.12..)i(..n}\right]\left[N-n-1\right]}{\left[V_{0.12\ldots n}\right]\left[1-r^2_{0i.12\ldots)i(..n}\right]}$$

Testing for the significance of $b_{01.234} = -.3605$ (chronological age) and substituting the values found in the multiple correlation table,

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1/ Helen M. Walker, Elementary Statistical Methods. Henry Holt and Company, New York, 1943.

2/ Kelley, op. cit.

the formula will read

$$F_{1.735} = \frac{-.3605^2 \times -.5092 \times 735}{22.9343 \times (1-.0059)} = 2.1342$$

which is the same as t^2. $t = \sqrt{2.1342} = 1.4677$ which is equivalent to a tail area of .0721. This value may be read directly from the table on "The Distribution of Students' t,"[1] or may be computed from the table of areas of the normal curve. The value of 1.4677 is equivalent to an area of .4292. The tail area is equal to .50 - .4292 or .0728 = q. The two tails have an area of .1416, therefore p = .14. This result indicates that the weight assigned to chronological age in this study might happen by chance fourteen times out of one hundred. This probability does not pass the criterion of significance which is .02 or less, but it does indicate that the result cannot be accounted for entirely by chance.[2]

In the same way the other b coefficients are tested for their significance. The significance of these coefficients may be found in Table 6. They are as follows:

$b_{01.234}$ (chronological age) t = 1.4677 which is equivalent to a tail area of .0721, p = .14.

$b_{02.134}$ (intelligence) t = 5.02 which is equivalent to a tail area of .0000003, p = .0000006.

$b_{03.124}$ (grade) t = 1.6496 which is equivalent to a tail area of

1/ Charles C. Peters and Walter R. Van Voorhis, Statistical Procedures and Their Mathematical Bases. McGraw-Hill Book Co., New York, 1940.

2/ Henry E. Garrett, Statistics in Psychology and Education. Longmans, Green and Co., New York, 1941.

.0495, p = .10.

$b_{04.123}$ (socio-economic status) t = .3655 which is equivalent to a tail area of .3551, p = .71.

The most significant criterion used for predicting success in reading comprehension is intelligence. The least significant influence is socio-economic status. In order of importance the variables read (1) intelligence, (2) grade, (3) chronological age, and (4) socio-economic status. Intelligence is highly significant while chronological age and grade are not the result of entire chance although they do not pass the accepted criteria of significance. Socio-economic status seems to have no significance. These weights and their significance are listed in Table 6.

Computation of the teacher-influence score.-- From the regression equation an estimated reading comprehension score has been computed for each teacher. The estimated reading score for the Teacher #1 group is 3.9611.[1/] The data on this group show that when the pupils were tested in September and again in January, each pupil received a certain growth score. Pupil #1, Raymond, had an increase of three points in January. Pupil #2, Everett, increased his score by nine points. Pupil #3, George, increased his score by seven points, etc. The average observed growth or change in score for the entire group was 5.7.

The regression equation estimated a growth of 3.9611 for the group. The actual or observed average growth was 5.7. This group did much better work than one would expect considering their chronological

1/ Appendix, p. 144

Table 6. The Partial Regression Coefficients and Their Significance in the Study of Reading Comprehension.

	b Coefficients	Weights	t	p
$b_{01.234}$	Chronological Age	-.3605	1.4677	.14
$b_{02.134}$	Intelligence	.1019	5.0200	.0000006
$b_{03.124}$	Grade	.7998	1.6496	.0990
$b_{04.123}$	Socio-Economic Status	.0032	.3655	.7114

age, intelligence, grade, and socio-economic status. In fact, the pupils earned 1.7389 points that cannot be accounted for by the variables studied. This amount of change over that estimated is designated as a teacher-influence score.

A teacher-influence score is computed for each teacher in the experiment. These teacher-influence scores range from 4.759 to -2.4792. They are listed in Table 7.

Relationship between the teacher-influence scores and the results of the teacher examinations.-- The last and most important finding in this part of the study is the amount of relationship between the teacher-influence scores and the scores obtained on the teacher examinations. Since the tests are important factors in the selection of teachers, it is desirable to know whether the teacher who receives a high teacher-influence score also receives high scores on the teacher examinations.

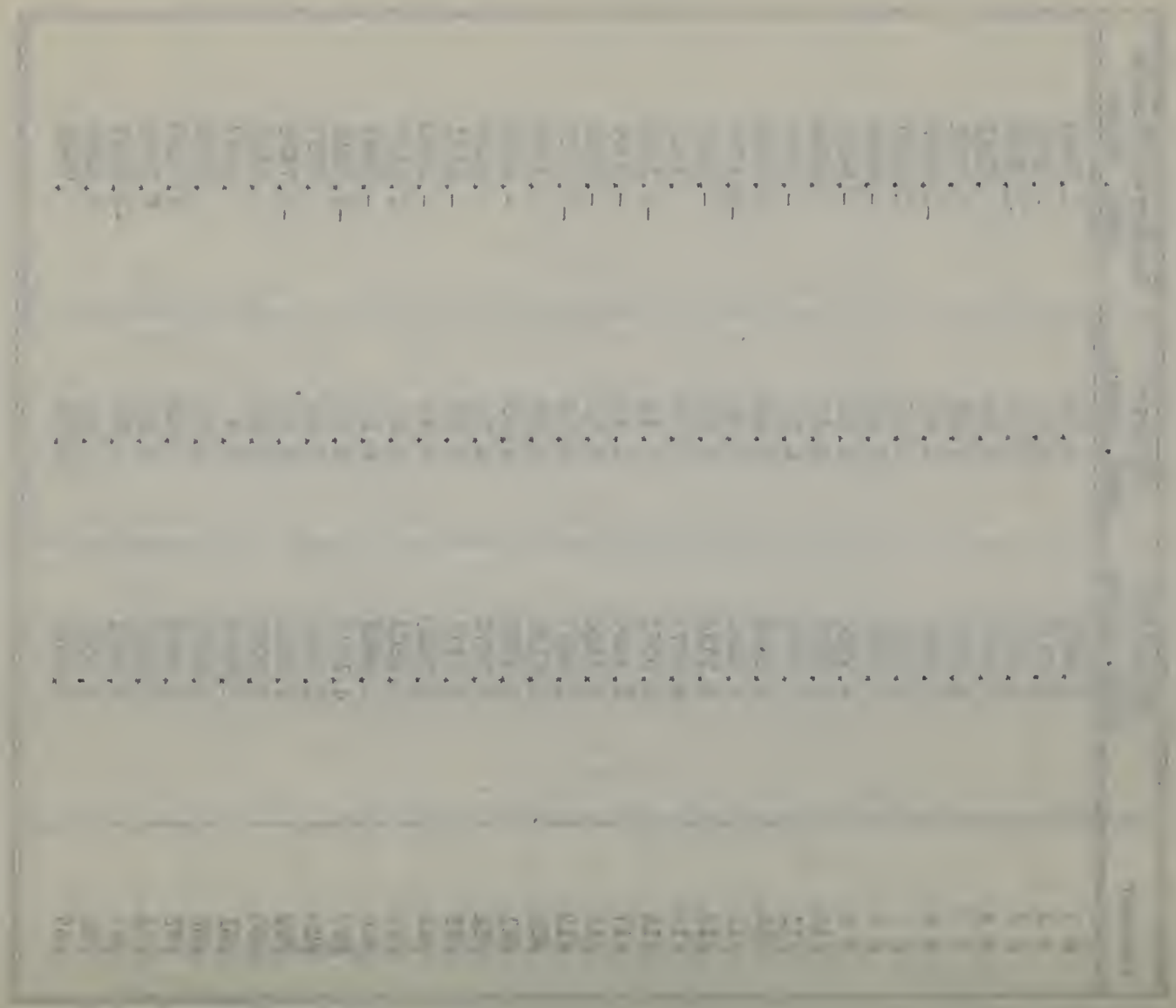
Zero-order correlations are computed between the teacher-influence score in reading comprehension and the scores on the scholastic aptitude test, the test on professional information, and the general culture test. The relationship, as determined by the Pearson product moment method, between the teacher-influence scores in reading comprehension and scholastic aptitude scores is $r = -.0986$.

The correlation between the teacher-influence scores in reading and the scores on the professional information tests is $r = .0088$.

The correlation between the teacher-influence scores in reading and the scores on the general culture test is $r = .0601$.

Table 7. Teacher-Influence Scores in Reading Comprehension

Teacher	Estimated Read. Score	Observed Read. Score	Teacher-Influence Read. Score
# 1	3.9611	5.70	1.7389
# 2	3.6156	3.05	-.5656
# 3	4.9359	3.35	-1.5859
# 4	3.8329	4.55	.7171
# 5	4.6299	7.40	2.7701
# 6	3.4332	1.60	-1.8332
# 7	5.2103	6.45	1.2397
# 8	3.8299	3.40	-.4299
# 9	4.7903	4.15	-.6403
#10	3.5636	4.40	.8364
#11	3.6885	3.15	-.5385
#12	4.1664	6.40	2.2336
#13	5.0292	2.55	-2.4792
#14	4.7110	3.80	-.9110
#15	4.9075	5.10	.1925
#16	4.6001	3.45	-1.1501
#17	2.4500	1.95	-.5000
#18	2.7155	2.45	-.3655
#19	5.9227	3.65	-2.2727
#20	3.7122	3.90	.1878
#21	2.4808	2.00	-.4808
#22	3.7872	4.75	.9628
#23	3.0111	2.80	-.2111
#24	5.1430	4.85	-.2930
#25	3.2801	4.80	1.5199
#26	2.9847	2.10	-.8847
#27	4.1916	2.65	-1.5416
#28	2.7793	3.45	.6707
#29	6.2939	4.55	-1.7439
#30	5.7065	5.95	.2435
#31	2.8003	2.9	.0997
#32	5.3997	5.95	.5503
#33	5.0910	9.85	4.7590
#34	6.0266	9.20	3.1734
#35	4.0931	2.80	-1.2931
#36	4.5337	6.15	1.6163
#37	5.2555	6.05	.7945



These correlations with their significance are tabulated in Table 8.

An appraisal of these coefficients of correlation is made according to R. A. Fisher's method which involves the transformation of the r scale, so that its sampling distribution becomes approximately normal. The formula used to transform the r to z follows:

$$z_r = 1.1512925 \left(\log \frac{1+r}{1-r}\right)$$

The standard deviation of the sampling distribution of any given r is

$$\sigma_{z_r} = \frac{1}{\sqrt{N-3}}$$

When these formulas are applied to the coefficients of correlation of this study the measures of reliability are as follows:

1. Teacher-influence reading scores and scholastic aptitude scores:

$$r = -.0986$$

$$z_r = 1.1513\left(\log \frac{1.0986}{.9014}\right) = 1.1513(\log 1.2187) = 1.1513 \times .0864 = -.0995$$

$$\sigma_{z_r} = \frac{1}{\sqrt{37-3}} = .1715$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.0995}{.1715} = .5801$$

This obtained z is more than five-tenths or approximately one-half its standard error. It has no significance.

2. Teacher-influence reading scores and professional information scores:

$r = .0083$

$z_r = 1.1513(\log \frac{1.0083}{.9917}) = 1.1513(\log 1.0167) = 1.1513 \times .0086 = .0099$

$\sigma_{z_r} = .1715$

$\frac{z_r}{\sigma_{z_r}} = \frac{.0099}{.1715} = .0577$

The obtained z is approximately one-twentieth as large as its standard error. It has no significance.

3. Teacher-influence reading scores and general culture scores:

$r = .0601$

$z_r = 1.1513(\log \frac{1.0601}{.9399}) = 1.1513(\log 1.1278) = 1.1513 \times .0531 = .0611$

$\sigma_{z_r} = .1715$

$\frac{z_r}{\sigma_{z_r}} = \frac{.0611}{.1715} = .3563$

The obtained z is approximately one-third as large as its standard error. It has no significance.

These coefficients and their significance are listed in Table 8.

Table 8. Coefficients of Correlation of Teacher-Influence Scores in Reading Comprehension With Percentile Scores on the Teacher Examinations.

	Schol. Apt. Examination	Prof. Inf. Examination	Gen. Culture Examination
Teacher-Influence Scores in Reading Comprehension	$r = -.0986$ $z_r = -.0995$	$r = .0083$ $z_r = .0099$	$r = .0601$ $z_r = .0611$
Significance of Correlations	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$

Summary.-- In this chapter the statistical procedure for dealing with the data as it concerns reading comprehension has been described. A multiple correlation table according to the Truman L. Kelley method is illustrated. The multiple regression equations are developed from the data in the multiple correlation table. A predictive mean score is determined for each group and this is compared with the observed mean score giving a teacher-influence score. Correlations are computed between the teacher-influence scores and the results of the teacher examinations. Such statistics as the coefficient of multiple correlation, the significance of the multiple R, the coefficient of multiple determination, the standard error of estimate, the significance of the b coefficient, and zero-order correlations with their significance have been explained.

Conclusion.-- It would seem from a study of the results of the simple correlations that there is practically no relationship between successful teaching of reading comprehension as defined in this study and success in teacher-examinations. The teachers who did well in the examinations do not necessarily receive high teacher-influence scores. In fact, a candidate for a teaching position may receive high ratings on examinations yet when it comes to teaching reading may be much less successful than a candidate who receives low ratings on the teacher examinations.

Since there appears to be no correlation in this study between teaching success in reading and success in the teacher examinations, it is worthwhile to consider for a moment the qualities or character-

istics or teacher-skills required for successful teaching. The achievement tests in reading are administered to the pupils at the beginning of the term so that the teacher may discover what particular techniques have not been mastered in each grade. The results of the tests in Providence show that reading is not fully mastered at any one point and that this subject affords plenty of difficulties in grades four to six. Providence pupils do not learn to read in final form in grades one to three. The teachers of grades four, five, and six must, therefore, be familiar with the latest and best basal techniques for teaching reading. They must also be acquainted with the most recent and progressive supplementary devices. They must possess such personal traits as friendliness, kindness, cheerfulness, and patience together with the many other characteristics associated with good teaching.

This study shows that the particular traits and skills necessary for the successful teaching of reading are in no way measured by the teacher examinations. It demonstrates that academic and intellectual abilities above a certain amount that is probably necessary for the completion of college work, do not function particularly in the teaching of reading in the elementary grades. Likewise, certain cultural and professional information does not function in the teaching of reading to these pupils. The teacher examinations are in no way indicative of future teaching efficiency in reading as measured by standardized tests in grades four to six in Providence.

A summary of statistical data from the multiple correlation table with reading comprehension as the dependent variable.-- A summary of statistical data is presented for the convenience of the reader. This data has been fully explained in the preceding pages.

Regression Equation:

$$\bar{X}_0 = -.3605X_1 + .1019X_2 + .7998X_3 + .0032X_4 - 9.4779$$

Coefficient of Multiple Correlation (R):

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0} = 1 - \frac{22.9343}{25.0340} = 1 - .9161 = .0839$$

$$R = \sqrt{.0839} = .2897$$

Significance of Multiple R:

$$F_{n,(N-n-1)} = \frac{V_{0.12...n}/n}{\frac{V_{0.12...n}}{N-n-1}} = \frac{V_0R^2/n}{\frac{V_0(1-R^2)}{N-n-1}} = \frac{\frac{R^2}{n}}{\frac{1-R^2}{N-n-1}}$$

$$F_{4,735} = \frac{.0839/4}{.9161/735} = \frac{.021}{.00125} = 16.8 = t^2$$

$t = \sqrt{16.8} = 4.0988$ which is equivalent to a tail area of

$.50 - .49997 = .00003$

$p = .00006$

Coefficient of Multiple Determination:

$$R^2 = .0839$$

Standard Error of Estimate:

$$\sigma_{0.1234} = \sigma_0\sqrt{1-R^2} = 5.0034\sqrt{1 - .2897} = 4.2164$$

Significance of b Coefficients:

$$F_{1(N-n-1)} = \frac{\left[b_{0i.12...)i(...n}\right]^2\left[V_{i.12...)i(...n}\right]\left[N-n-1\right]}{\left[V_{0.12...n}\right]\left[1-r^2_{0i.12...)i(...n}\right]}$$

Significance of Coefficient for Chronological Age ($b_{01.234}$ = -.3605):

$$F_{1.735} = \frac{-.3605^2 \times \frac{-1}{-1.9635} \times 735}{22.9343 \times (1 - .0059)} = \frac{.1300 \times .5092 \times 735}{22.7990} =$$

$$\frac{48.6570}{22.7990} = 2.1342 = t^2$$

$t = \sqrt{2.1342} = 1.4677$ which is equivalent to a tail area of

$.50 - .4279 = .0721 = q$

$2q$, or p, = .1442

Significance of Coefficient for Intelligence ($b_{02.134}$ = .1019):

$$F_{1.735} = \frac{.1019^2 \times \frac{-1}{-.0136} \times 735}{22.9343 \times (1 - .0294)} = \frac{.0104 \times 73.5294 \times 735}{22.2600} =$$

$$\frac{562.0545}{22.2600} = 25.2450 = t^2$$

$t = \sqrt{25.2450} = 5.02$ which is equivalent to a tail area of

$.0000003 = q$

$2q = p = .0000006$

Significance of Coefficient for Grade ($b_{03.124}$ = .7998):

$$F_{1.735} = \frac{.7998^2 \times \frac{-1}{-7.5671} \times 735}{22.9343 \times (1 - .0037)} = \frac{.6397 \times .1322 \times 735}{22.8494} =$$

$$\frac{62.1810}{22.8494} = 2.7213 = t^2$$

$t = \sqrt{2.7213} = 1.6496$ which is equivalent to a tail area of

$.50 - .4505 = .0495 = q$

$2q = p = .0990$

Significance of Coefficient for Socio-Economic Status ($b_{04.123} = .0032$):

$$F_{1.735} = \frac{.0032^2 \times \frac{-1}{-.0024} \times 735}{(22.9343)(1 - .0001)} = \frac{.00001 \times 416.6667 \times 735}{22.9320} =$$

$$\frac{3.0870}{22.9320} = .1346 = t^2$$

$t = \sqrt{.1346} = .3655$ which is equivalent to a tail area of

$.50 - .1443 = .3557 = q$

$2q = p = .7114$

CHAPTER VII

STATISTICAL TREATMENT OF THE DATA AS IT PERTAINS TO VOCABULARY

The Extent to Which Growth in Vocabulary in Grades 4-6 is Determined by the Combined Action of the Chronological Age, Intelligence, Grade, and Socio-Economic Status of the Pupils

The multiple regression equation.— The same procedure is followed in the study of vocabulary as was followed in the study of reading comprehension. A mean growth score in vocabulary must be predicted for each group of pupils. This prediction takes into account the combined influence of chronological age, intelligence, grade, and socio-economic status on the vocabulary score.

A multiple regression equation is required in order to obtain a predicted or estimated score. A five variable multiple correlation table has been prepared. Vocabulary is the dependent variable and the four independent variables are chronological age, intelligence, grade, and socio-economic status. The variables are designated by the following symbols: X_0, vocabulary; X_1, chronological age; X_2, intelligence; X_3, grade; and X_4, socio-economic status. The Truman L. Kelley method[1/] has been chosen as the best procedure to be followed in solving this problem. In preparing a multiple correlation table certain data are necessary and these values are listed in Tables 9 and 10.

1/ Kelley, op. cit., p. --.

Data Required for the Multiple Regression Equation in the Study of Growth in Vocabulary

Table 9. Means, Variances, and Sigmas of the Variables

	Chron. Age	Intelligence	Grade	Socio-Econ.	Vocabulary
Mean	10.4331	132.5945	4.9811	42.8110	6.4055
Variance	.9332	133.0216	.3365	461.8631	34.1056
Sigma	.9660	11.5335	.5801	21.4910	5.8400

Table 10. Variances and Covariances of the Several Variables in the Study of Vocabulary

	Chron. Age	Intelligence	Grade	Socio-Econ.	Vocabulary
Chron. Age	.9332	.8880	.3402	-1.9888	-.3007*
Intell.		133.0216	3.5587	75.2522	-5.7522*
Grade			.3365	.6844	-.2449*
Socio-Econ.				461.8631	-6.2126*
Vocabulary					34.1056

*Signs are changed when used in the multiple correlation table.

Table 11. Multiple Correlation Table With Five Variables, Vocabulary the Dependent Variable.

Row	Div. or Mult.	X_1	X_2	X_3	X_4	X_0	Col. 1	Col. 2	Col. 3	Col. 4	Check Col.
1		V_1 .9332	.8880	.3402	-1.9888	.3007	-1.				.4733
1′	R_1 ÷ -.9332	-1.	(-.9516)	(-.3646)	(2.1312)	(-.3222)	1.0716				
20		V_2	133.0216	3.5587	75.2522	5.7522	0	-1.			218.4727
21	R_1 x -.9516		-.8450	-.3237	1.8925	-.2861	.9516				-.4504
2	Sum		132.1766	3.2350	77.1447	5.4661	.9516	-1.			218.0223
2′	R_2 ÷ -132.1766		-1.	(-.0245)	(-.5836)	(-.0414)	-.0072	.0076			218.0224
30				V_3 .3365	.6844	.2449	0	0	-1.		5.1647
31	R_1 x -.3646			-.1240	.7251	-.1096	.3646				-.1726
32	R_2 x -.0245			-.0793	-1.8900	-.1339	-.0233	.0245			-5.3415
3	Sum			.1332	-.4805	.0014	.3413	.0245	-1.		-.3494
3′	R_3 ÷ -.1332			-1.	(3.6074)	(-.0105)	-2.5623	-.1839	7.5075		-.3459
40					V_4 461.8631	6.2126	0	0	0	-1.	542.0235
41	R_1 x 2.1312				-4.2385	.6409	-2.1312				1.0087
42	R_2 x -.5836				-45.0216	-3.1900	-.5554	.5836			-127.2378
43	R_3 x 3.6074				-1.7334	.0051	1.2312	.0884	-3.6074		-1.2604
4	Sum				410.8696	3.6686	-1.4554	.6720	-3.6074	-1.	414.5340
4′	R_4 ÷ -410.8696				-1.	(-.0089)	.0035	-.0016	.0088	.0024	414.5382
00						V_0 34.1056	0	0	0	0	46.6160
01	R_1 x -.3222					-.0969	.3222				-.1525
02	R_2 x -.0414					-.2263	-.0394	.0414			-9.0261
03	R_3 x -.0105					-.0000	-.0036	-.0003	.0105		.0037
04	R_4 x -.0089					-.0327	.0130	-.0060	.0321	.0089	-3.6894
0	Sum					$V_{a\,1234}$ 33.7497	$t_{0.1}$ .2922	$-b_{02}$ .0351	$-b_{03}$ .0426	$-b_{04}$ .0089	33.7517
0′	R_0 ÷ -33.7497					-1.	-.0087	-.0010	-.0012	-.0003	33.7497
1x1′							-1.0716				
2x2′							-.0069	-.0076			
3x3′							-.3745	-.0045	-7.5075		
4x4′							-.0051	-.0011	-.0317	-.0024	
0x0′	A						-.0025	-.0000	-.00005	-.0000	
Sum	B						-.9606	-.0132	-.5392	-.0024	
r^2	A/B					$r^2_{01.234}$ .0026		r^2_{02} .0027	r^2_{03} .0001	r^2_{04} .0011	

Regression Equation $\bar{X}_0 = -.2922X_1 - .0351X_2 - .0426X_3 - .0089X_4 + 6.4055 - (-.2922 \times 10.4331) - (-.0351 \times 132.5945) - (-.0426 \times 4.9811) - (-.0089 \times 42.8110)$

$\bar{X}_0 = -.2922X_1 - .0351X_2 - .0426X_3 - .0089X_4 + 14.7014$

| | | |

Table 11. (concluded)

X_0 = Vocabulary

X_1 = Chronological Age

X_2 = Intelligence

X_3 = Grade

X_4 = Socio-Economic Status

A check on the b coefficients:

$-b_{01.234} = .2922 \quad .2922 \times .9332\ (V_1) = .2727$

$-b_{02.134} = .0351 \quad .0351 \times .8880\ (CV_{12}) = .0312$

$-b_{03.124} = .0426 \quad .0426 \times .3402\ (CV_{13}) = .0145$

$-b_{04.123} = .0089 \quad .0089 \times -1.9888\ (CV_{14}) = -.0177$

Sum = $.3007\ (CV_{01})$

Values of Variances (Used in testing significance of b coefficients)

$V_{1.0234} = -1 \div -.9606 = 1.0410$

$V_{2.0134} = -1 \div -.0132 = 75.7576$

$V_{3.0124} = -1 \div -.5392 = 1.8546$

$V_{4.0123} = -1 \div -.0024 = 416.6667$

Values of r^2 (Used in testing the significance of the b coefficients)

$r^2_{01.234} = .0026$

$r^2_{02.134} = .0027$

$r^2_{03.124} = .0001$

$r^2_{04.123} = .0011$

Partial regression coefficients.— The b, or partial regression coefficients, are obtained from the vocabulary multiple correlation table. The weights are as follows:

$b_{01.234} = -.2922$, the net weight assigned to X_1 (chronological age)

$b_{02.134} = -.0351$, the net weight assigned to X_2 (intelligence)

$b_{03.124} = -.0426$, the net weight assigned to X_3 (grade)

$b_{04.123} = -.0089$, the net weight assigned to X_4 (socio-economic status)

The multiple regression equation.— Having found the weights to be assigned to the different independent variables it is now possible to write the regression equation to be applied to each of the thirty-seven teachers to predict a vocabulary score for each group.

The regression equation reads

$$\bar{X}_0 = -.2922X_1 - .0351X_2 - .0426X_3 - .0089X_4 + 14.7014$$

Having the mean chronological age of a group of pupils (X_1), the mean Pintner intelligence score (X_2), the mean grade of a group (X_3), and the mean socio-economic status score (X_4), it is possible to predict the most probable mean score in vocabulary (X_0) for each group of pupils. The values used in the computations for each group in vocabulary are found in Table 12.

The use of the regression equation.— Following is an example of the use of the regression equation. Teacher #1 has under her supervision a group of twenty pupils. The data available for this group are: mean chronological age, 10 years; mean Pintner intelligence

Table 12. Regression Equation Values for Vocabulary As Applied to Each Teacher or Group.

Teacher	X_1 Chron. Age Weight	Mean Score	X_2 Intelligence Weight	Mean Score	X_3 Grade, Year of Sch. Weight	Mean Score	X_4 Soc.-Ec. Stat. Weight	Mean Score	Constant	Estim. Growth
# 1	-.2922x	10.0	-.0351x	129.0	-.0426x	4.675	-.0089x	49.95	14.7014	6.6077
# 2	-.2922x	9.40	-.0351x	128.5	-.0426x	4.1	-.0089x	34.0	14.7014	6.9670
# 3	-.2922x	9.83	-.0351x	136.7	-.0426x	4.9	-.0089x	34.0	14.7014	6.5196
# 4	-.2922x	10.35	-.0351x	130.85	-.0426x	4.5	-.0089x	34.15	14.7014	6.5887
# 5	-.2922x	10.5	-.0351x	135.0	-.0426x	5.0	-.0089x	43.0	14.7014	6.2991
# 6	-.2922x	10.15	-.0351x	125.65	-.0426x	4.5	-.0089x	53.3	14.7014	6.6681
# 7	-.2922x	10.68	-.0351x	139.9	-.0426x	5.25	-.0089x	26.1	14.7014	6.2142
# 8	-.2922x	10.54	-.0351x	129.3	-.0426x	4.7	-.0089x	53.95	14.7014	6.4028
# 9	-.2922x	11.22	-.0351x	136.4	-.0426x	5.325	-.0089x	48.4	14.7014	5.9777
#10	-.2922x	10.22	-.0351x	127.9	-.0426x	4.5	-.0089x	27.7	14.7014	6.7859
#11	-.2922x	10.44	-.0351x	127.45	-.0426x	4.825	-.0089x	26.2	14.7014	5.7286
#12	-.2922x	10.33	-.0351x	132.45	-.0426x	4.675	-.0089x	41.4	14.7014	6.4663
#13	-.2922x	12.095	-.0351x	139.9	-.0426x	5.675	-.0089x	22.7	14.7014	5.8129
#14	-.2922x	10.95	-.0351x	137.1	-.0426x	5.0	-.0089x	52.15	14.7014	6.0125
#15	-.2922x	10.53	-.0351x	138.1	-.0426x	5.0	-.0089x	34.4	14.7014	6.2580
#16	-.2922x	10.77	-.0351x	136.3	-.0426x	5.0	-.0089x	22.7	14.7014	6.3553
#17	-.2922x	9.77	-.0351x	119.3	-.0426x	4.0	-.0089x	29.4	14.7014	7.2271
#18	-.2922x	9.62	-.0351x	121.35	-.0426x	4.0	-.0089x	30.2	14.7014	7.1818
#19	-.2922x	10.32	-.0351x	144.3	-.0426x	5.325	-.0089x	49.35	14.7014	5.9550
#20	-.2922x	10.79	-.0351x	129.75	-.0426x	4.725	-.0089x	24.75	14.7014	6.5728
#21	-.2922x	9.93	-.0351x	120.2	-.0426x	4.0	-.0089x	28.4	14.7014	7.1577
#22	-.2922x	9.31	-.0351x	130.05	-.0426x	4.05	-.0089x	40.65	14.7014	6.3819
#23	-.2922x	10.42	-.0351x	123.1	-.0426x	4.5	-.0089x	32.0	14.7014	6.8594
#24	-.2922x	10.53	-.0351x	139.1	-.0426x	5.0	-.0089x	76.15	14.7014	5.8514
#25	-.2922x	9.40	-.0351x	125.5	-.0426x	4.0	-.0089x	46.7	14.7014	6.9369
#26	-.2922x	10.31	-.0351x	124.35	-.0426x	4.275	-.0089x	27.8	14.7014	6.8949
#27	-.2922x	10.85	-.0351x	132.7	-.0426x	5.0	-.0089x	18.7	14.7014	6.4938
#28	-.2922x	9.98	-.0351x	123.35	-.0426x	4.0	-.0089x	25.45	14.7014	7.0587
#29	-.2922x	10.42	-.0351x	149.45	-.0426x	5.0	-.0089x	93.8	14.7014	5.3632
#30	-.2922x	11.47	-.0351x	142.5	-.0426x	5.85	-.0089x	37.4	14.7014	5.7660
#31	-.2922x	9.77	-.0351x	122.6	-.0426x	4.0	-.0089x	33.8	14.7014	9.0721
#32	-.2922x	9.92	-.0351x	141.3	-.0426x	4.7	-.0089x	92.55	14.7014	5.8193
#33	-.2922x	10.22	-.0351x	138.6	-.0426x	4.85	-.0089x	78.4	14.7014	5.9458
#34	-.2922x	11.72	-.0351x	145.65	-.0426x	6.0	-.0089x	27.85	14.7014	5.6610
#35	-.2922x	10.92	-.0351.	131.0	-.0426x	5.0	-.0089x	49.95	14.7014	6.2550
#36	-.2922x	10.9	-.0351x	134.95	-.0426x	5.0	-.0089x	48.9	14.7014	6.1315
#37	-.2922x	11.7	-.0351x	137.8	-.0426x	6.0	-.0089x	34.6	14.7014	5.8824

Regression Equation: $\bar{X}_0 = -.2922X_1 - .0351X_2 - .0426X_3 - .0089X_4 + 14.7014$

score, 129; mean grade, 4.675; mean socio-economic status score, 49.95. Substituting these values in the regression equation it reads

$$\bar{X}_0 = -.2922 \times 10 - .0351 \times 129 - .0426 \times 4.675 - .0089 \times 49.95 + 14.7014$$

$$\bar{X}_0 = 6.6077$$

This means that with the above criteria as a basis for an estimate or prediction, the most probable predicted mean score of growth in vocabulary for the group taught by Teacher #1 is 6.6077. This same procedure is followed for each of the thirty-seven teachers participating in the experiment.

The coefficient of multiple correlation (R).— We now want to explain how reliable these predictions are that are being estimated from the regression equation. What correlation exists between the predicted mean scores in vocabulary and the actual or observed mean scores determined by the standardized tests? The formula used for finding this relationship (R) is $R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0}$, and the square root is extracted from the result for R. Substituting the values for $V_{0.1234}$ and V_0 which are the variance between vocabulary and the combined other variables, and the variance within the vocabulary distribution itself, and which are found in the multiple correlation table, the equation or formula reads

$$R^2_{0.1234} = 1 - \frac{33.7497}{34.1056} = 1 - .9896 = .0104$$

$$R_{0.1234} = \sqrt{.0104} = .1020$$

To evaluate the reliability of this R, the formula is taken from the manuscript of Dr. Truman L. Kelley's new book[1] and is as follows:

1/ Kelley, op. cit., p. --.

$$F_{n,N-n-1} = \frac{V_{0\ 12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}} = \frac{V_0R^2/n}{\frac{V_0(1-R^2)}{N-n-1}} = \frac{\frac{R^2}{n}}{\frac{1-R^2}{N-n-1}}$$

in which N is the number of cases in the sample, and n is the number of independent variables in the multiple correlation problem. Substituting the known numerical values, the equation reads

$$F_{4.735} = \frac{.0104/4}{.9896/735} = \frac{.0026}{.00134} = 1.9403 = t^2$$

$t = \sqrt{1.9403} = 1.3929$ which is equivalent to a tail area of $.50 - .4177 = .0823 = q$

$2q = p = .1646$

This value is not highly significant. There is, however, a fairly strong trend that the correlation cannot be accounted for entirely by chance.

The interpretation of the coefficient of multiple correlation in terms of the coefficient of multiple determination (R^2).— $R^2_{0.1234}$ measures the proportion of variance in X_0 that is dependent upon or predicted by X_1, X_2, X_3, and X_4 combined. In the study of vocabulary $R^2_{0.1234} = .0104$, which indicates that 1.04 per cent. of the variance in vocabulary is accounted for by the variances in chronological age, intelligence, grade, and socio-economic status combined. The remaining 98 per cent. of the variance must be accounted for in some other way.

The interpretation of the coefficient of multiple correlation in terms of the standard error of estimate.— The standard error of esti-

mate is the standard error of the estimated scores in vocabulary. Since the correlation between the estimated and the observed scores is not perfect, each estimated score may be in error. The amount of these errors present in the scores which are estimated is described by R, the coefficient of multiple correlation. The standard deviation of these errors is the standard error of estimate. The formula used is

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2}$$

Substituting the known values, the formula reads

$$\sigma_{0.1234} = 5.8400 \sqrt{1 - .0104} = 5.84 \times .9948 = 5.8096$$

This means that about two-thirds of the predicted vocabulary scores will be within 5.8 points of the obtained vocabulary scores.

The reliability of the b coefficients.— The b coefficients are also subject to error and their reliability can be found from the following formula which is taken from the manuscript of Dr. Truman L. Kelley's new book:[1/]

$$F_{1(N-n-1)} = \frac{\left[b_{01.2...)i(...\bar{n}-\tilde{b}}\right]^2 \left[V_{i.1211)i(..n}\right]\left[N-n-1\right]}{\left[V_{0.12...n}\right]\left[1-r^2_{01.12..)i(..n}\right]}$$

Testing for the significance of $b_{01.234}$ - -.2922 (chronological age) and substituting the numerical values found in the correlation table, the formula reads

$$F_{1.735} = \frac{-.2922^2 \times \frac{-1}{-.9606} \times 735}{33.7497 \times (1 - .0026)} = \frac{.0854 \times 1.0410 \times 735}{33.7497 \times .9974} = \frac{65.3415}{33.6620} =$$

1/ Kelley, op. cit., p. —.

$$1.9411 = t^2$$

$t = \sqrt{1.9411} = 1.3932$ which is equivalent to a tail area of

$.50 - .4177 = .0823 = q$

$2q = p = .1646$

The significance of the tail area may be read directly from the table on "The Distribution of Students' t"[1] or may be calculated from the table of areas of the normal curve. The $t = 1.3932$ is equivalent to an area of .4177, from the table of areas. The tail has an area of $.50 - .4177 = .0823$. Two tails have areas of .1646, therefore $p = .16$. This means that the weight assigned to chronological age in this problem of vocabulary might happen by chance sixteen times out of one hundred. This result is not highly significant yet it does indicate a fair significance and this result cannot be accounted for entirely by chance.

The other b coefficients are tested for their significance in like manner. The reliability of these coefficients may be found in Table 13. They are as follows:

$b_{01.234}$ (chronological age) $t = 1.3932 \Rightarrow$ a tail area of .0823, $p = .1646$

$b_{02.134}$ (intelligence) $t = 1.4089 \Rightarrow$ a tail area of .0808, $p = .1616$

$b_{03.124}$ (grade) $t = .2805 \Rightarrow$ a tail area of .3897, $p = .7794$

$b_{04.123}$ (socio-ec. status) $t = .8521 \Rightarrow$ a tail area of .1977, $p = .3954$

The most significant criteria used for predicting a mean vocabulary growth score is intelligence with chronological age having about the same significance. These influences cannot be explained as entirely

1/ Peters and Van Voorhis, op. cit., p. 488.

Table 13. The Partial Regression Coefficients and Their Significance in the Study of Vocabulary.

b Coefficients		Weights	t	p
$b_{01.234}$	Chronological Age	-.2922	1.3932	.1646
$b_{02.134}$	Intelligence	-.0351	1.4089	.1616
$b_{03.124}$	Grade	-.0426	.2805	.7794
$b_{04.123}$	Socio-Econ. Status	-.0089	.8521	.3954

chance happenings. Socio-economic status has no real significance and grade has the least significance of all. The variables in order of importance are (1) intelligence, (2) chronological age, (3) socio-economic status, and (4) grade.

Computation of the Teacher-Influence Scores.-- By means of the regression equation each teacher has been assigned an estimated mean vocabulary growth score, one that she is expected to achieve with her pupils in the light of their ages, intelligence, grade, and home background. Besides this predicted score each teacher has for her group a mean observed growth score which is the difference between the test scores in September, 1942, and the scores in January, 1943. The difference between the predicted score and the observed score is called the teacher-influence score. It is the score that is not affected by the pupils' age, intelligence, grade, or socio-economic status. An example of this procedure follows: Miss B., Teacher #1, has an estimated vocabulary mean score for her group of 6.6077. This was determined from the regression equation on vocabulary. When her pupils were tested in September and again in January the average growth for the group was 6.6.[1/]

Considering the age, intelligence, grade, and socio-economic status of the pupils in this group, the teacher should have had a mean growth of 6.6077. She actually had a mean growth of 6.6000. The group did not do as well as expected. They fell down .0077 points. This loss is called a teacher-influence score of -.0077. In like man-

1/ Appendix, p. 144.

Table 14. Teacher-Influence Scores in Vocabulary.

Teacher	Estimated Vocabulary Score	Observed Vocabulary Score	Teacher-Influence Vocabulary Score
# 1	6.6077	6.6	-.0077
# 2	6.9670	5.5	-1.4670
# 3	6.5196	5.6	-.9196
# 4	6.5887	10.1	3.5113
# 5	6.2991	8.75	2.4509
# 6	6.6681	7.25	.5819
# 7	6.2142	7.05	.8358
# 8	6.4028	5.45	-.9528
# 9	5.9777	6.1	.1223
#10	6.7859	5.85	-.9359
#11	5.7286	8.5	2.7714
#12	6.4663	8.25	1.7837
#13	5.8129	5.35	-.4629
#14	6.0125	4.55	-1.4625
#15	6.2580	8.55	2.2920
#16	6.3553	6.6	.2447
#17	7.2271	6.65	-.5771
#18	7.1818	5.2	-1.9818
#19	5.9550	9.1	3.1450
#20	6.5728	6.15	-.4228
#21	7.1577	10.05	2.8923
#22	6.8819	6.5	-.3819
#23	6.8594	6.6	-.2594
#24	5.8514	.85	-5.0014
#25	6.9369	9.85	2.9131
#26	6.8949	5.1	-1.7948
#27	6.4938	4.25	-2.2438
#28	7.0587	4.4	-2.6587
#29	5.3632	4.45	-.9132
#30	5.7660	5.75	-.0160
#31	9.0721	6.95	-2.1221
#32	5.8193	6.55	.7307
#33	5.9458	6.75	.8042
#34	5.6610	6.35	.6890
#35	6.2550	4.8	-1.4550
#36	6.1315	3.75	-2.3815
#37	5.8824	5.05	-.8324

ner a teacher-influence score is computed for each teacher. These influence scores are listed in Table 14.

Relationship between the teacher-influence scores and the results of the teacher examinations.-- The most important finding in this study is the relationship that exists between the teacher-influence score and the results of the teacher examinations. Zero-order correlations are computed between the teacher-influence scores and the scores on the scholastic aptitude test, the professional information test, and the general culture test. These correlations are listed in Table 15. The correlation between teacher-influence scores and scholastic aptitude is $r = -.0295$. The correlation with professional information is $r = .0413$. The correlation with general culture is $r = .1269$.

There seems to be no relationship between success in teaching vocabulary and success in the teacher examinations. The correlations are tabulated in Table 15.

An appraisal of these coefficients of correlations is made according to R. A. Fisher's method of transforming the r to z. The formulas used are

$$z_r = 1.1512925(\log \frac{1+r}{1-r}) \text{ and } \sigma_{z_r} = \frac{1}{\sqrt{N-3}}$$

and they are applied to the coefficients with the following results:

1. Teacher-Influence Vocabulary Score and Scholastic Aptitude Score

$r = -.0295$

$z_r = 1.1513(\log \frac{1.0295}{.9705}) = 1.1513(\log 1.0607) = 1.1513 \times .0253 = -.0291$

$\sigma_{z_r} = \frac{1}{\sqrt{37 - 3}} = \frac{1}{5.8309} = .1715$

$\frac{z_r}{\sigma_{z_r}} = \frac{.0291}{.1715} = .1696$

The obtained z is approximately one-eighth as large as its standard error. It has no significance.

2. Teacher-Influence Vocabulary Score and Professional Information Score

$r = .0413$

$z_r = 1.1513(\log \frac{1+.0413}{1-.0413}) = 1.1513(\log 1.0861) = 1.1513 \times .0374 = .0431$

$\frac{z_r}{\sigma_{z_r}} = \frac{.0431}{.1715} = .2513$

The obtained z is approximately one-fourth as large as its standard error. It has no significance.

3. Teacher-Influence Vocabulary Score and General Culture Score

$r = .1269$

$z_r = 1.1513(\log \frac{1+.1269}{1-.1269}) = 1.1513(\log 1.2906) = 1.1513 \times .1106 = .1273$

$\frac{z_r}{\sigma_{z_r}} = \frac{.1273}{.1715} = .7422$

The obtained z is almost as large as its standard error. It has

$$\frac{\quad}{\quad} = \quad$$

Table 15. Coefficients of Correlation of Teacher-Influence Scores in Vocabulary With Percentile Scores on the Teacher Examinations.

	Scholastic Apt. Examination	Professional Inf. Examination	Gen. Culture Examination
Teacher-Influence Scores in Vocabulary	$r = -.0295$ $z_r = -.0291$	$r = .0413$ $z_r = .0431$	$r = .1269$ $z_r = .1273$
Significance of Correlations	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$

no significance.

Summary.-- This chapter deals with the data on vocabulary. A multiple correlation table according to the Truman L. Kelley method makes possible the preparation of multiple regression equations to be used in predicting a mean score in vocabulary for each of the thirty-seven groups of pupils. This predicted mean score is compared with the observed mean score of each group and the difference is called the teacher-influence score. Correlations are computed between the teacher-influence scores in vocabulary and the results of the teacher examinations in scholastic aptitude, professional information, and general culture. These correlations are too low to have any predictive value. Such statistics as the coefficient of multiple correlation, the significance of the multiple R, the coefficient of multiple determination, the standard error of estimate, the significance of the b coefficients, and zero-order correlations with their significance have been computed.

Conclusion.-- From a study of the simple correlations one may conclude that there is no relationship between the successful teaching of vocabulary in grades four to six as measured by standardized tests and success in the teacher examinations.

A summary of statistical data from the multiple correlation table with vocabulary as the dependent variable.-- A summary of statistical data is presented for the convenience of the reader. This data has already been explained in the preceding pages.

Regression equation:

$$\bar{X}_0 = -.2922X_1 - .0351X_2 - .0426X_3 - .0089X_4 + 14.7014$$

Coefficient of multiple correlation (R):

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0} = 1 - \frac{33.7497}{34.1056} = 1 - .9896 = .0104$$

$$R = \sqrt{.0104} = .1020$$

Significance of multiple R:

$$F_{n,(N-n-1)} = \frac{V_{0.12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}} = \frac{\frac{V_0 R^2/n}{V_0(1-R^2)}}{N-n-1} = \frac{\frac{R^2/n}{1-R^2}}{N-n-1}$$

$$F_{4,735} = \frac{.0104/4}{.9896/735} = \frac{.0026}{.00134} = 1.9403 = t^2$$

$t = \sqrt{1.9403} = 1.3929$ which is equivalent to a tail area of

$.50 - .4177 = .0823$

$p = .1646$

Coefficient of multiple determination:

$R^2 = .0104$

Standard error of estimate:

$$\sigma_{0.1234} = \sigma_0\sqrt{1 - R^2} = 5.8400\ \sqrt{1 - .0104} = 5.84 \times .9948 =$$

5.8096

Significance of b coefficients:

$$F_{1(N-n-1)} = \frac{\left[b_{0i.12...)i(...n} - \tilde{b}\right]^2 \left[V_{i.12...)i(...n}\right]\left[N-n-1\right]}{\left[V_{0.12...n}\right]\left[1-r^2_{0i.12...)i(...n}\right]}$$

Coefficient for Chronological Age ($b_{01.234} = -.2922$):

$$F_{1.735} = \frac{-.2922^2 \times \frac{-1}{-.9606} \times 735}{33.7497 \times (1 - .0026)} = \frac{.0854 \times 1.0410 \times 735}{33.7497 \times .9974} =$$

$$\frac{65.3415}{33.6620} = 1.9411 = t^2$$

$t = \sqrt{1.9411} = 1.3932$ which is equivalent to a tail area of $.50 - .4177 = .0823$

$p = .1646$

Coefficient for Intelligence ($b_{02.134} = -.0351$)

$$F_{1.735} = \frac{-.0351^2 \times \frac{-1}{-.0132} \times 735}{33.7497 \times (1 - .0027)} = \frac{.0012 \times 75.7576 \times 735}{33.7497 \times .9973} =$$

$$\frac{66.8115}{33.6586} = 1.9850 = t^2$$

$t = \sqrt{1.9850} = 1.4089$ which is equivalent to a tail area of $.50 - .4192 = .0808$

$p = .1616$

Coefficient for Grade ($b_{03.124} = -.0426$)

$$F_{1.735} = \frac{-.0426^2 \times \frac{-1}{-.5392} \times 735}{33.7497 \times (1 - .0001)} = \frac{.0018 \times 1.8546 \times 735}{33.7479 \times .9999} =$$

$$\frac{2.4255}{33.7463} = .0787 = t^2$$

$t = \sqrt{.0787} = .2805$ which is equivalent to a tail area of $.50 - .1103 = .3897$. $p = .7794$

CHAPTER VIII

STATISTICAL TREATMENT OF THE DATA AS IT PERTAINS TO ARITHMETIC REASONING

The Extent to Which Growth in Arithmetic Reasoning in Grades 4-6 is Determined by the Combined Action of the Chronological Age, Intelligence, Grade, and Socio-Economic Status of the Pupils

The multiple regression equation.-- The statistical procedure in the study of arithmetic reasoning is the same as that followed in reading and vocabulary. The problem is to predict a probable mean growth score in arithmetic reasoning for each group of pupils after giving consideration to the weighted influences of chronological age, intelligence, grade, and socio-economic status combined.

To solve the problem, multiple regression equations are prepared from a multiple correlation table in which the Truman L. Kelley method is followed. In this particular study, arithmetic reasoning is the dependent variable, while chronological age, intelligence, grade, and socio-economic status are the independent variables. The variables are designated as X_0, arithmetic reasoning; X_1, chronological age; X_2, intelligence; X_3, grade; X_4, socio-economic status.

The data required for the multiple-correlation solution are listed in Tables 16 and 17.

Partial regression coefficients.-- The b, or partial regression coefficients, are developed by means of the multiple correlation table

Data Required for the Multiple Regression Equation in the Study of Growth in Arithmetic Reasoning

Table 16. Means, Variances, and Sigmas of the Variables

	Chron. Age	Intelligence	Grade	Socio-Econ.	Arith. R.
Mean	10.4331	132.5945	4.9811	42.8110	5.2729
Variance	.9332	133.0216	.3365	461.8631	31.2168
Sigma	.9660	11.5335	.5801	21.4910	5.5872

Table 17. Variances and Covariances of the Variables in the Study of Arithmetic Reasoning

	Chron. Age	Intelligence	Grade	Socio-Econ.	Arith. R.
Chron. Age	.9332	.8880	.3402	-1.9888	-.5257*
Intell.		133.0216	3.5587	75.2522	-4.7299*
Grade			.3365	.6844	-.2645*
Socio-Ec.				461.8631	-5.3073*
Arith. R.					31.2168

*Signs changed when used in the multiple correlation table.

Table 18. Multiple Correlation Table With Five Variables, Arithmetic Reasoning the Dependent Variable.

Row	Div. or Mult.	X_1	X_2	X_3	X_4	X_0	Col. 1	Col. 2	Col. 3	Col. 4	Check Col.
1		V_1 .9332	.8880	.3402	-1.9888	+.5257	-1				.6983
1′	R_1 ÷ -.9332	-1	(-.9516)	(-.3646)	(2.1312)	(-.5633)	1.0716				
20		V_1 133.0216	3.5587	75.2522	+4.7299	0	-1				217.4504
21	R_1 x -.9516		-.8450	-.3237	1.8925	-.5003	.9516				-.6645
2	Sum		132.1766	3.2350	77.1447	4.2296	.9516	-1			216.7859
2′	R_2 ÷ -132.1766		-1	(-.0245)	(-.5836)	(-.0320)	-.0072	.0076			216.7859
30				V_3 .3365	.6844	+.2645	0	0	-1		5.1843
31	R_1 x -.3646			-.1240	.7251	-.1917	.3646				-.2546
32	R_2 x -.0245			-.0793	-1.8900	-.1036	-.0233	.0245			-5.3113
3	Sum			.1332	-.4805	-.0308	.3413	.0245	-1		-.3816
3′	R_3 ÷ -.1332			-1	(3.6074)	(.2313)	-2.5623	-.1839	7.5075		-.3781
40					V_4 461.8631	+5.3073	0	0	0	-1	541.1182
41	R_1 x 2.1312				-4.2385	1.1204	-2.1312				1.4882
42	R_2 x -.5836				-45.0216	-2.4684	-.5554	.5836			-126.5163
43	R_3 x 3.6074				-1.7334	-.1111	1.2312	.0884	-3.6074		-1.3766
4	Sum				410.8696	3.8482	-1.4554	.6720	-3.6074	-1	414.7135
4′	R_4 ÷ -410.8696				-1	(-.0094)	.0035	-.0016	.0088	.0024	414.7178
00						V_0 31.2168	0	0	0	0	42.0442
01	R_1 x -.5633					-.2961	.5633				-.3934
02	R_2 x -.0320					-.1353	-.0305	.0320			-6.9371
03	R_3 x .2313					-.0071	.0789	.0057	-.2313		-.0882
04	R_4 x -.0094					-.0362	.0137	-.0063	.0339	.0094	-3.8983
0	Sum					$V_{0.1234}$ 30.7421	$-b_{01}$ .6254	$-b_{02}$ .0314	$-b_{03}$ .1973	$-b_{04}$ .0094	30.7272
0′	R_0 ÷ -30.7421					-1	-.0203	-.0010	.0064	-.0003	30.7421
1x1′							-1.0716				
2x2′							-.0069	-.0076			
3x3′							-.8745	-.0045	-7.5075		
4x4′							-.0051	-.0011	-.0317	-.0024	
0x0′	A					A	-.0127	-.0000	-.0013	-.00000282	
Sum	B					B	-1.9708	-.0132	-7.5405	-.0024	
Ratio	$A/B = r^2$					A/B $R^2_{0.1234}$ .0064	r^2_{01} .0024	r^2_{02} .0002	r^2_{04} .0012		

$\bar{X}_0 = -.6254X_1 - .0314X_2 + .1973X_3 - .0094X_4 + 5.2729 - (-.6254 \times 10.4331) - (-.0314 \times 132.5945) - (.1973 \times 4.9811) - (-.0094 \times 42.8110)$

$\bar{X}_0 = -.6254X_1 - .0314X_2 + .1973X_3 - .0094X_4 + 15.3809$

| | | |

Table 18. (concluded)

X_0 = Arithmetic Reasoning

X_1 = Chronological Age

X_2 = Intelligence

X_3 = Grade

X_4 = Socio-Economic Status

A check on the b coefficients:

$-b_{01.234} = .6254 \quad .6254 \times .9332\ (V_1) = .5836$

$-b_{02.134} = .0314 \quad .0314 \times .8880\ (CV_{12}) = .0279$

$-b_{03.124} = -.1973 \quad -.1973 \times .3402\ (CV_{13}) = -.0671$

$-b_{04.123} = .0094 \quad .0094 \times -1.9888\ (CV_{14}) = -.0187$

$\text{Sum} = .5257\ (CV_{01})$

Values of Variances: (Used in testing significance of b coefficients)

$V_{1.0234} = -1 + -1.9708 = .5074$

$V_{2.0134} = -1 + -.0132 = 75.7576$

$V_{3.0124} = -1 + -7.5405 = .1326$

$V_{4.0123} = -1 + -.0024 = 416.6667$

Values of r^2: (Used in testing significance of b coefficients)

$r^2_{01.234} = .0064$

$r^2_{02.134} = .0024$

$r^2_{03.124} = .0002$

$r^2_{04.123} = .0012$

(Table 18) and they furnish the net weights assigned to the independent variables. From the multiple correlation table the weights read:

$b_{01.234} = -.6254$, the net weight assigned to chronological age (X_1),

$b_{02.134} = -.0314$, the net weight assigned to intelligence (X_2),

$b_{03.124} = .1973$, the net weight assigned to grade (X_3), and

$b_{04.123} = -.0094$, the net weight assigned to socio-economic status (X_4).

Multiple regression equation.-- Knowing the values of the b coefficients it is now possible to write the regression equation for arithmetic reasoning which reads

$$\bar{X}_0 = -.6254X_1 - .0314X_2 + .1973X_3 - .0094X_4 + 15.3809$$

This means that having the mean score of X_1 (chronological age), the mean score of X_2 (intelligence, Pintner test), the mean score of X_3 (grade), and the mean score of X_4 (socio-economic status), it is possible to predict the most probable mean score in $\bar{X}_0$ (arithmetic reasoning) for each group of pupils. The values used in the computations for each group in arithmetic reasoning are found in Table 19.

The use of the regression equation.-- Following is an example of the use of the regression equation: Teacher #1 has a group of twenty pupils. The data available from this group of pupils are: mean chronological age, ten years; mean intelligence score, 129.0; mean grade, 4.675; mean socio-economic status score, 49.95. Substituting these values in the regression equation for this group it reads

$$\bar{X}_0 = (-.6254 \times 10) - (.0314 \times 129.0) + (.1973 \times 4.675) - (.0094 \times 49.95) + 15.3809$$

$$\bar{X}_0 = 5.5292$$

Table 19. Regression Equation Values for Arithmetic Reasoning As Applied to Each Teacher or Group.

Teacher	X_1 Chron. Age Mean Weight	Score	X_2 Intelligence Mean Weight	Score	X_3 Grade, Year of Sch. Mean Weight	Score	X_4 Soc. Ec. Stat. Mean Weight	Score	Constant	Estim. Growth
# 1	-.6254	10.0	-.0314	129.0	.1973	4.675	-.0094	49.95	15.3809	5.5292
# 2	-.6254	9.4	-.0314	128.5	.1973	4.1	-.0094	34.0	15.3809	6.2565
# 3	-.6254	9.83	-.0314	136.7	.1973	4.9	-.0094	34.0	15.3809	5.5880
# 4	-.6254	10.35	-.0314	130.85	.1973	4.5	-.0094	34.15	15.3809	5.4662
# 5	-.6254	10.5	-.0314	135.0	.1973	5.0	-.0094	43.0	15.3809	5.1575
# 6	-.6254	10.15	-.0314	125.65	.1973	4.5	-.0094	52.3	15.3809	5.4840
# 7	-.6254	10.68	-.0314	139.9	.1973	5.25	-.0094	26.1	15.3809	5.0992
# 8	-.6254	10.54	-.0314	129.3	.1973	4.7	-.0094	53.95	15.3809	5.1494
# 9	-.6254	11.22	-.0314	136.4	.1973	5.325	-.0094	48.4	15.3809	4.6765
#10	-.6254	10.22	-.0314	127.9	.1973	4.5	-.0094	27.7	15.3809	5.5992
#11	-.6254	10.44	-.0314	127.45	.1973	4.825	-.0094	26.2	15.3809	5.5555
#12	-.6254	10.33	-.0314	132.45	.1973	4.675	-.0094	41.4	15.3809	5.2948
#13	-.6254	12.095	-.0314	139.9	.1973	5.675	-.0094	22.7	15.3809	4.3301
#14	-.6254	10.95	-.0314	137.1	.1973	5.0	-.0094	52.15	15.3809	4.7242
#15	-.6254	10.53	-.0314	137.1	.1973	5.0	-.0094	34.4	15.3809	5.1222
#16	-.6254	10.77	-.0314	136.3	.1973	5.0	-.0094	22.7	15.3809	5.1386
#17	-.6254	9.77	-.0314	119.3	.1973	4.0	-.0094	29.4	15.3809	6.0375
#18	-.6254	9.62	-.0314	121.35	.1973	4.0	-.0094	30.2	15.3809	6.0595
#19	-.6254	10.32	-.0314	144.3	.1973	5.325	-.0094	49.35	15.3809	4.9825
#20	-.6254	10.79	-.0314	129.75	.1973	4.725	-.0094	24.75	15.3809	5.2581
#21	-.6254	9.93	-.0314	120.2	.1973	4.0	-.0094	28.4	15.3809	5.9186
#22	-.6254	9.31	-.0314	130.05	.1973	4.05	-.0094	40.65	15.3809	5.8918
#23	-.6254	10.42	-.0314	123.1	.1973	4.5	-.0094	32.0	15.3809	5.5860
#24	-.6254	10.53	-.0314	139.1	.1973	5.0	-.0094	76.15	15.3809	5.6984
#25	-.6254	9.4	-.0314	125.5	.1973	4.0	-.0094	49.7	15.3809	5.8834
#26	-.6254	10.31	-.0314	124.35	.1973	4.275	-.0094	27.8	15.3809	5.6106
#27	-.6254	10.85	-.0314	132.7	.1973	5.0	-.0094	18.7	15.3809	5.2392
#28	-.6254	9.98	-.0314	123.35	.1973	4.0	-.0094	25.45	15.3809	5.8162
#29	-.6254	10.42	-.0314	149.45	.1973	5.0	-.0094	93.8	15.3809	4.2763
#30	-.6254	11.47	-.0314	142.5	.1973	5.85	-.0094	37.4	15.3809	4.5357
#31	-.6254	9.77	-.0314	122.6	.1973	4.0	-.0094	33.8	15.3809	5.8926
#32	-.6254	9.92	-.0314	141.3	.1973	4.7	-.0094	92.55	15.3809	4.7974
#33	-.6254	10.22	-.0314	138.6	.1973	4.85	-.0094	78.4	15.3809	4.8572
#34	-.6254	11.72	-.0314	145.65	.1973	6.0	-.0094	27.85	15.3809	4.3998
#35	-.6254	10.92	-.0314	131.0	.1973	5.0	-.0094	49.95	15.3809	4.9551
#36	-.6254	10.9	-.0314	134.95	.1973	5.0	-.0094	48.9	15.3809	4.8534
#37	-.6254	11.7	-.0314	137.8	.1973	6.0	-.0094	34.6	15.3809	4.5954

Regression Equation: $\bar{X}_0 = -.6254X_1 - .0314X_2 + .1973X_3 - .0094X_4 + 15.3809$

The predicted mean growth score in arithmetic reasoning for Teacher #1 is 5.5292. This same pattern of application is followed for each teacher in the experiment.

The coefficient of multiple correlation (R).-- We wish to discover how reliable these predictions are which are obtained from the multiple regression equation. How strong is the relationship between the predicted scores and the observed scores? This can be determined by multiple R. The formula used to obtain R is

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0}$$

These values for $V_{0.1234}$, the variance between arithmetic reasoning and the combined other variables, and V_0, the variance within the arithmetic reasoning distribution itself, are found in the multiple correlation table, Table 18. Substituting the known values in the formula, it reads

$$R^2_{0.1234} = 1 - \frac{30.7421}{31.2168} = 1 - .9848 = .0152$$

$$R_{0.1234} = \sqrt{.0152} = .1233$$

We wish to appraise the significance of this R value. To do so we use a formula taken from the manuscript of Dr. Truman L. Kelley's new book, "Fundamentals of Statistics,"[1] which is as follows:

$$F_{n,(N-n-1)} = \frac{V_{0\Delta 12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}} = \frac{V_0 R^2/n}{\frac{V_0(1-R^2)}{N-n-1}} = \frac{\frac{R^2}{n}}{\frac{1-R^2}{N-n-1}}$$

1/ Kelley, op. cit., p.--.

Substituting the numerical values the equation reads

$$F_{4,735} = \frac{.0152/4}{.9849/735} = \frac{.0038}{.0013} = 2.9231 = t^2$$

$$t = \sqrt{2.9231} = 1.7097$$

From the normal probability curve, 1.7097 is equivalent to an area of .4564 from the mean. The tail area = .50 - .4564 = .0436 = q. 2q (the two tails) have an area of .0872 = p. This p does not quite pass the criterion of significance which is .02 or less, but indications are that the result cannot be accounted for entirely by chance. A p between .10 and .20 is usually considered fairly strong.[1/]

The interpretation of the multiple correlation coefficient in terms of the coefficient of multiple determination (R^2).-- R^2 measures the proportion of variance in X_0 (arithmetic reasoning) that is dependent upon or predicted by X_1, X_2, X_3, and X_4 combined. In this section of the study $R^2_{0.1234} = .0152$ which indicates that 1.52 per cent. of the variance in arithmetic reasoning is accounted for by the combined variances in chronological age, intelligence, grade, and socio-economic status. The remaining 98.48 per cent. of the variance must be accounted for in some other way.

The interpretation of the coefficient of multiple correlation in terms of the standard error of estimate.-- A probable or predicted mean score in arithmetic reasoning has been estimated for each group of pupils. We found that the correlation between the predicted and ob-

1/ Henry B. Garrett, Statistics in Psychology and Education. Longmans, Green, and Company, New York, 1941.

served mean scores is not perfect. There is a difference or an error in most of these predicted scores. The multiple R gives a measure of the amount of these errors, and the standard deviation of these errors is measured by the standard error of estimate.

The formula used to measure the standard error of estimate is

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2_{0.1234}}$$

Substituting the numerical values in this equation, the formula reads

$$\sigma_{0.1234} = 5.5872 \sqrt{1 - .0152} = 5.5872 \times .9924 = 5.5447$$

This means that two-thirds of the predicted arithmetic reasoning values will be within 5.5447 points of the obtained arithmetic reasoning scores.

The reliability of the b coefficients.-- The b coefficients are subject to errors also. Their reliability can be measured by means of a formula taken from the manuscript of Dr. Truman L. Kelley's new book, "Fundamentals of Statistics."[1/] The formula reads

$$F_{1(N-n-1)} = \frac{\left[b_{01.2\ldots)i(\ldots\bar{n}} - \tilde{b}\right]^2 \left[V_{i.12\ldots)i(\ldots n}\right] \left[N-n-1\right]}{\left[V_{0.12\ldots n}\right] \left[1-r^2_{0i.12\ldots)i(\ldots n}\right]}$$

Testing for the significance of $b_{01.234} = -.6254$ (chronological age) and substituting the values found in the multiple correlation table, the formula reads

$$F_{1.735} = \frac{-.6254^2 \times \overline{-1}.9708 \times 735}{30,7421 \times (1 - .0064)} = \frac{.3911 \times .5074 \times 735}{30,7421 \times .9936} =$$

$$\frac{145.8240}{30,5454} = 4.7740 = t^2$$

1/ Kelley, op. cit., p. --.

$t = \sqrt{4.7740} = 2.1849$ which is equivalent to a tail area of $.50 - .4854 = .0146 = q$

$2q = .0292 = p$ and is highly significant.

The $t = 2.1849$ value may be interpreted from a table on the "Distribution of Students' t"[1] or it may be computed from the table of area of the normal curve. The value 2.1849 is equivalent to a curve area of .4854. In this case the tail area is .50 - .4854 which is equal to $.0146 = q$. The two tails have an area of .0292 which equals p. This means that the weight assigned to chronological age might happen by chance only about two times out of one hundred, which indicates this weight is significant.

In the same way the other b coefficients are tested for their significance. The results are found in Table 20. They are as follows:

$b_{01.234} = -.6254$ (chronological age), $t = 2.1849$ ⇒ tail area of .0146, $p = .0292$

$b_{02.134} = -.0314$ (intelligence), $t = 1.3478$ ⇒ a tail area of .0901, $p = .1802$

$b_{03.124} = .1973$ (grade), $t = .3526$ ⇒ a tail area of .3632, $p = .7264$

$b_{04.123} = -.0094$ (socio-economic status), $t = .9991$ ⇒ a tail area of .1611, $p = .3222$

The most significant criterion used for predicting arithmetic reasoning is chronological age. Intelligence does not pass the criterion of significance as this weight might happen by chance eighteen times out of a hundred although there is a fairly strong trend toward signifi-

1/ Peters and Van Voorhes, op. cit., p. 488.

Table 20. The Partial Regression Coefficients and Their Significance in the Study of Arithmetic Reasoning.

b coefficients		Weight	t	p
$b_{01.234}$	Chronological Age	-.6254	2.1849	.0292
$b_{02.134}$	Intelligence	-.0351	1.3478	.1802
$b_{03.124}$	Grade	.1973	.3526	.7264
$b_{04.123}$	Socio-Economic Status	-.0094	.9991	.3200

cance. Socio-economic status has no significance. Grade seems to have no significance.

Computation of the teacher-influence score.— An estimated mean arithmetic reasoning score has been computed for each teacher or group from the regression equation. The estimated arithmetic reasoning score for Teacher #1 is 5.5292 and this value was developed from the regression equation. When the pupils were tested in September and again in January, each pupil received a certain growth score.[1/] Pupil #1, Raymond, received a score of 37 in September and 42 in January. This makes a growth score in arithmetic reasoning of 5. Pupil #2, Everett, grew 8 points, while Pupil #3, George, receives 0 for a growth score. The average observed growth score in arithmetic reasoning for this group of pupils under Teacher #1 is 5.85.[2/]

According to the regression equation we may expect this group to have grown 5.5292 points. The group did better than was expected and has a surplus growth of .3208 which cannot be accounted for by the variables studied. This extra growth is called the teacher-influence score. Such a teacher-influence score is computed for each group in the study. The teacher-influence score range is from -3.71 to 5.69. These scores are listed in Table 21.

The relationship between the teacher-influence scores and the results of the teacher examinations.— The most important finding as far as this study is concerned is the amount of relationship between the

1/ Appendix, p. 144.

2/ Loc. cit.

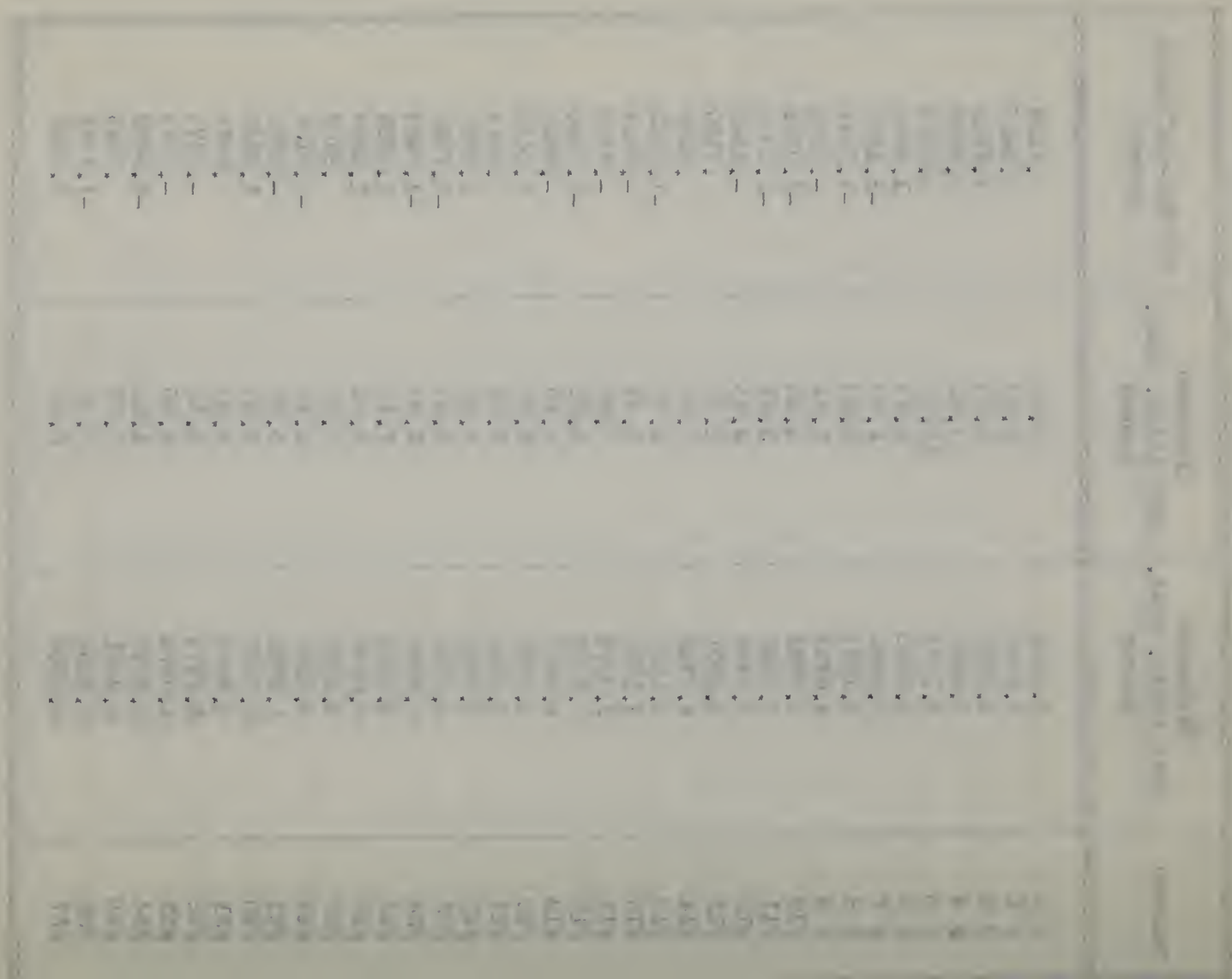
[illegible]

[illegible]

[illegible]

Table 21. Teacher-Influence Scores in Arithmetic Reasoning.

Teacher	Estimated Mean Arith. Reas. Scores	Observed Mean Arith. Reas. Scores	Teacher-Influence Scores
# 1	5.5292	5.85	.3208
# 2	6.2565	8.30	2.0435
# 3	5.5880	8.30	2.7120
# 4	5.4662	7.95	2.4838
# 5	5.1575	10.85	5.6925
# 6	5.4840	6.95	1.4660
# 7	5.0992	2.90	-2.1992
# 8	5.1494	3.80	-1.3494
# 9	4.6765	3.95	-.7265
#10	5.5992	4.55	-1.0494
#11	5.5555	3.35	-2.2055
#12	5.2948	4.45	-.8448
#13	4.3301	5.05	.7199
#14	4.7242	5.25	.5258
#15	5.1222	3.50	-1.6222
#16	5.1386	5.05	-.0886
#17	6.0375	5.30	-.7375
#18	6.0595	4.80	-1.2595
#19	4.9825	4.10	-.8825
#20	5.2581	6.60	1.3419
#21	5.9186	6.20	.2814
#22	5.8918	8.80	1.9082
#23	5.5860	2.80	-2.7860
#24	5.6984	3.95	-1.7484
#25	5.8834	7.15	1.2666
#26	5.6106	6.65	1.0394
#27	5.2392	5.75	.5108
#28	5.8162	2.10	-3.7162
#29	4.2763	3.90	-.3763
#30	4.5357	5.80	1.2643
#31	5.8926	6.50	.6074
#32	4.7974	4.55	-.2474
#33	4.8572	4.30	-.5572
#34	4.3998	1.05	-3.3498
#35	4.9551	5.75	.7949
#36	4.8534	3.50	-1.3534
#37	4.5954	6.85	2.2546



teacher-influence scores and the results of the teacher examinations. The candidates for teaching positions were chosen by the superintendent and consequently elected by the school committee partly because of their ratings on the examinations.

Zero-order correlations are computed between the teacher-influence scores and the results of the scholastic aptitude test, the test in professional information, and the general culture test. These correlations are found in Table 22. The correlation between arithmetic reasoning and scholastic aptitude is -.0936. Between professional information and arithmetic reasoning the correlation is -.0555. With general culture the correlation is -.0394.

An appraisal of these coefficients of correlation is made according to R. A. Fisher's method of transforming the r to z. The formulas used are as follows:

$$z_r = 1.1512925(\log \frac{1+r}{1-r}) \text{ and } \sigma_{z_r} = \frac{1}{\sqrt{N-3}}$$

1. Teacher-influence arithmetic reasoning score and scholastic aptitude score:

$$r = -.0936$$

$$z_r = 1.1513(\log \frac{1.0936}{.9064}) = 1.1513(\log 1.2065) = 1.1513 \times .0828 = -.0953$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.0953}{.1715} = .5556$$

The obtained z is approximately one-half as large as the standard error. It has no significance.

Table 22. Coefficients of Correlation of Teacher-Influence Scores in Arithmetic Reasoning With Percentile Scores on the Teacher Examinations and Their Significance.

	Scholastic Apt. Examination	Professional Inf. Examination	Gen. Culture Examination
Teacher-Influence Scores in Arithmetic Reas.	$r = -.0936$	$r = -.0555$	$r = -.0394$
	$z_r = -.0953$	$z_r = -.0566$	$z_r = -.0385$
Significance of the Correlations	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$

2. Teacher-influence arithmetic reasoning score and professional information score:

$$r = -.0555$$

$$z_r = 1.1513(\log \frac{1.0555}{.9445}) = 1.1513(\log 1.1175) = 1.1513 \times .0492 = -.0566$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.0566}{.1715} = .3300$$

The obtained z is approximately one-third as large as its standard error. It has no significance.

3. Teacher-influence arithmetic reasoning score and general culture score:

$$r = -.0394$$

$$z_r = 1.1513(\log \frac{1.0394}{.9606}) = 1.1513(\log 1.0820) = 1.1513 \times .0334 = -.0385$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.0385}{.1715} = .2244$$

The obtained z is approximately one-fifth as large as its standard error. It has no significance.

Summary.— In this chapter the method of dealing with the data on arithmetic reasoning which was used in the study has been described. A multiple correlation table such as is devised by Dr. Truman L. Kelley is illustrated. Multiple regression equations are developed and used to estimate probable growth scores for each group of pupils. These estimated scores are compared with the actual observed scores for a teacher-influence score. Correlations are computed between the teacher-

influence scores and the results of the teacher examinations. The coefficient of multiple correlation, the significance of this statistic, the coefficient of multiple determination, the standard error of estimate, the significance of the b coefficient, and zero-order correlations between the teacher-influence scores and the results of the teacher examinations have been computed.

Conclusion.-- From a study of the results of the correlations we may conclude that no relationship has been found between efficiency in teaching arithmetic reasoning as measured by standardized tests and success in the teacher examinations.

A consideration of the particular skills which a successful teacher of arithmetic in grades four to six should possess may offer an explanation as to why there is no correlation found between the teacher-influence scores and the scores on the teacher examinations. From literature on the subject of arithmetic one may conclude that the two generally accepted major objectives in teaching arithmetic are (1) to teach the proper appreciation of the cultural value of mathematics, and (2) to help the pupils acquire the ability to perform with accuracy and understanding the arithmetic computations required by everyday life. In the elementary grades the second objective is the one which is emphasized.

To accomplish this second objective, teachers of arithmetic in the elementary grades find that considerable time must be devoted to drill teaching. There is drill for initial learning, drill for maintenance, and remedial drill. After the testing program is completed the teacher

becomes aware of the specific difficulties which the pupils are experiencing and suitable material must be assembled for the correction of these deficiencies. A special kind of teaching and drill which fits the need of the class must follow.

The teacher who is successful in teaching arithmetic must possess the same personal characteristics as the teacher who is successful in teaching reading. She must first discover the needs of the class. She must see to it that the pupils understand what they are doing, why they are doing it, and the best method for doing it. Care must be taken to avoid forming poor habits. There must be a maximum of attention on the part of the pupil. The work must be individual as well as in groups. Pupils must be motivated by the idea of self-competition. The pupils must be made interested in their remedial instruction.

After a consideration of the skills required of the teacher, the question that arises is whether these particular traits are being measured in the teacher examinations. This study indicates that the characteristics necessary for the successful teaching of arithmetic in the elementary grades are not measured by and cannot be predicted from the teacher examinations. The successful teacher of mathematics in grades four to six does not require very superior intelligence or such cultural and professional information as is measured by the teacher examinations.

A summary of statistical data from the multiple correlation table with arithmetic reasoning as the dependent variable.-- A summary of statistical data is presented for the convenience of the reader. This data has already been explained in the preceding pages.

Regression Equation:

$$\bar{X}_0 = -.6254X_1 - .0314X_2 + .1973X_3 - .0094X_4 + 15.3809$$

Coefficient of Multiple Correlation (R)

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0} = 1 - \frac{30.7421}{31.2168} = 1 - .9848 = .0152$$

$$R_{0.1234} = \sqrt{.0152} = .1233$$

Significance of Multiple R:

$$F_{n,(N-n-1)} = \frac{V_{0.12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}} = \frac{\frac{V_0 R^2/n}{V_0(1-R^2)}}{N-n-1} = \frac{\frac{R^2/n}{1-R^2}}{N-n-1}$$

$$F_{4,735} = \frac{.0152/4}{.9848/735} = \frac{.0038}{.0013} = 2.9231 = t^2$$

$t = \sqrt{2.9231} = 1.7097$ which is equivalent to a tail area of

$.50 - .4564 = .0436 = q$

$2q = .0872 = p$

Coefficient of Multiple Determination

$$R^2 = .0152$$

Standard Error of Estimate

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2} = 5.5872 \sqrt{1 - .0152} = 5.5873 \times .9924 =$$

5.5447

Significance of b coefficients

$$F_{1(N-n-1)} = \frac{\left[b_{0i.12\ldots)i(\ldots}\bar{n}-\bar{b}\right]^2 \left[V_{i.12\ldots)i(\ldots n}\right]\left[N-n-1\right]}{\left[V_{0.12\ldots n}\right]\left[1-r^2_{0i.12\ldots)i(\ldots n}\right]}$$

The Significance of the Coefficient for Chronological Age ($b_{01.234} = -.6254$)

$$F_{1.735} = \frac{-.6254^2 \times \overline{-1.9708} \times 735}{(30.7421) \times (1-.0064)} = \frac{.3911 \times .5074 \times 735}{30.7421 \times .9936} = \frac{145.8240}{30.5454} =$$

$$4.7740 = t^2$$

$$t = \sqrt{4.7740} = 2.1849 \text{ which is equivalent to a tail area of}$$

$$.50 - .4854 = .0146 = q$$

$$2q = .0292 = p$$

The Significance of the Coefficient for Intelligence ($b_{02.134} = -.0314$)

$$F_{1.735} = \frac{-.0314^2 \times \overline{-.0132} \times 735}{30.7421 \times (1 - .0024)} = \frac{.0010 \times 75.7576 \times 735}{30.7421 \times .9976} =$$

$$\frac{55.7130}{30.6683} = 1.8166 = t^2$$

$$t = \sqrt{1.8166} = 1.3478 \text{ which is equivalent to a tail area of}$$

$$.50 - .4099 = .0901 = q$$

$$2q = .1802 = p$$

The Significance of the Coefficient for Grade ($b_{03.124} = .1973$)

$$F_{1.735} = \frac{.1973^2 \times \overline{-7.5405} \times 735}{30.7421 \times (1 - .0002)} = \frac{.0389 \times .1326 \times 735}{30.7421 \times .9998} = \frac{3.822}{30.7360} =$$

$$.1243 = t^2$$

$$t = \sqrt{.1243} = .3526 \text{ which is equivalent to a tail area of}$$

$$.50 - .1368 = .3632 = q$$

$$2q = .7264 = p$$

The Significance of the Coefficient for Socio-Economic Status ($b_{04.123} = -.0094$)

$$F_{1.735} = \frac{-.0094^2 \times -.0024 \times 735}{30.7421 \times (1 - .0012)} = \frac{.0001 \times 416.6667 \times 735}{30.7421 \times .9988} =$$

$$\frac{30.6495}{30.7052} = .9982 = t^2$$

$t = \sqrt{.9982} = .9991$ which is equivalent to a tail area of

$.50 - .3389 = .1611 = q$

$2q = .3222 = p$

CHAPTER IX

THE STATISTICAL TREATMENT OF THE DATA AS IT PERTAINS TO ARITHMETIC FUNDAMENTALS

The Extent to Which Growth in Arithmetic Fundamentals in Grades 4-6 is Determined by the Combined Action of the Chronological Age, Intelligence, Grade, and Socio-Economic Status of the Pupils

The multiple regression equation.-- The aim in the study of arithmetic fundamentals is to predict growth in pupil achievement in this subject from a knowledge of the pupils' chronological ages, intelligence, grade, and socio-economic status. The technique used here is the same as that used with the other school subjects in preparing the multiple regression equation. The variables are designated as X_0, arithmetic fundamentals; X_1, chronological age; X_2, intelligence; X_3, grade; and X_4, socio-economic status. In the solution of the regression equation and a multiple R, Truman L. Kelley's method has been used.

The data required for the multiple regression equation and the multiple correlation table in the study of arithmetic fundamentals are found in Tables 23 and 24.

Partial Regression Coefficients.-- The b or partial regression coefficients are used in this study in giving the weight assigned to the independent variables. The weights used in the study of arithmetic

Data Required for the Multiple Regression Equation in the Study of Growth in Arithmetic Fundamentals

Table 23. Means, Variances, and Sigmas of the Variables

	Chron. Age	Intelligence	Grade	Socio-Econ.	Arith. F.
Mean	10.4331	132.5945	4.9811	42.8110	6.0070
Variance	.9332	133.0216	.3365	461.8631	25.8725
Sigma	.9660	11.5335	.5801	21.4910	5.0865

Table 24. Variances and Covariances of the Variables in the Study of Arithmetic Fundamentals

	Chron. Age	Intelligence	Grade	Socio-Econ.	Arith. R.
Chron. Age	.9332	.8880	.3402	-1.9888	-.5385*
Intell.		133.0216	3.5587	75.2522	-1.6426*
Grade			.3365	.6844	-.3355*
Socio-Ec.				461.8631	-3.6948*
Arith. F.					25.8725

*Signs changed when used in the multiple correlation table.

Table 25. Multiple Correlation Table With Five Variables, Arithmetic Fundamentals the Dependent Variable.

Row	Div. or Mult.	X_1	X_2	X_3	X_4	X_0	Col. 1	Col. 2	Col. 3	Col. 4	Check Col.
1		V_1 .9332	.8880	.3402	-1.9888	.5385	-1.				.7111
1′	R_1 ÷ -.9332	-1.	(-.9516)	(-.3646)	(2.1312)	(-.5770)	1.0716				
20		V_2 132.0216	3.5587	75.2522	1.6426	0	-1.				214.3631
21	R_1 x -.9516		-.8450	-.3237	1.8925	-.5124	.9516				-.6767
2	Sum		132.1766	3.2350	77.1447	1.1302	.9516	-1.			213.6864
2′	R_2 ÷ -132.1766		-1.	(-.0245)	(-.5836)	(.0086)	-.0072	.0076			213.6865
30				V_3 .3365	.6844	.3355	0	0	-1.		5.2553
31	R_1 x -.3646			-.1240	.7251	-.1963	.3646				-.2593
32	R_2 x -.0245			-.0793	-1.8900	-.0277	-.0233	.0245			-5.2353
3	Sum			.1332	-.4805	.1115	.3413	.0245	-1.		-.2393
3′	R_3 ÷ -.1332			-1.	(3.6074)	(-.8371)	-2.5623	-.1839	7.5075		-.2358
40					V_4 461.8631	3.6948	0	0	0	-1.	539.5057
41	R_1 x 2.1312				-4.2385	1.1477	-2.1312				1.5155
42	R_2 x -.5836				-45.0216	-.6596	-.5554	.5836			-124.7074
43	R_3 x 3.6074				-1.7334	.4022	1.2312	.0884	-3.6074		-.8633
4	Sum				410.8696	4.5851	-1.4554	.6720	-3.6074	-1.	415.4505
4′	R_4 ÷ -410.8696				-1.	(-.0112)	.0035	-.0016	.0088	.0024	415.4547
00						V_0 25.8725	0	0	0	0	32.0839
01	R_1 x -.5770					-.3107	.5770				-.4103
02	R_2 x -.0086					-.0097	-.0082	.0086			-1.8377
03	R_3 x -.8371					-.0933	-.2857	-.0205	.8371		.2003
04	R_4 x -.0112					-.0514	.0163	-.0075	.0404	.0112	-4.6530
0	Sum				$V_{0.1234}$	25.4074	$-b_{01}$.2994	$-b_{02}$.0194	$-b_{03}$.8775	$-b_{04}$.0112	25.3832
0′	R_0 ÷ -25.4074					-1.	-.0118	+.0008	-.0345	-.0004	25.4074
1x1′							-1.0716				
2x2′							-.0069	-.0076			
3x3′							-.8745	-.0045	-7.5075		
4x4′							-.0051	-.0011	-.0317	-.0024	
0x0′	A						-.0035	-.0000	-.0303	-.0000	
Sum	B						-1.9616	-.0132	-7.5695	-.0024	
Ratio	$A/B=r^2$					$r^2_{01.234}$.0018	r^2_{02}.0012	r^2_{03}.0040	r^2_{04}.0019		

$\bar{X}_0 = -.2994X_1+.0194X_2-.8775X_3-.0112X_4+6.0070-(-.2994\text{x}10.4331)-(.0194\text{x}132.5945)-(-.8775\text{x}4.9811)-(-.0112\text{x}42.8110)$

$\bar{X}_0 = -.2994X_1+.0194X_2-.8775X_3-.0112X_4+11.4088$

Table 25. (concluded)

X_0 = Arithmetic Fundamentals

X_1 = Chronological Age

X_2 = Intelligence

X_3 = Grade

X_4 = Socio-Economic Status

A check on the b coefficients:

$-b_{01.234} = .2994 \quad .2994 \times .9332\ (V_1) = .2794$

$-b_{02.134} = -.0194 \quad -.0194 \times .8880\ (CV_{12}) = -.0172$

$-b_{03.124} = .8775 \quad .8775 \times .3402\ (CV_{13}) = .2985$

$-b_{04.123} = .0112 \quad .0112 \times -1.9888\ (CV_{14}) = -.0222$

$\text{Sum} = .5385\ (CV_{01})$

Values of Variances: (Used in testing significance of b coefficients)

$V_{1.0234} = -1 \div -1.9616 = .5098$

$V_{2.0134} = -1 \div -.0132 = 75.7576$

$V_{3.0124} = -1 \div -7.5695 = .1321$

$V_{4.0123} = -1 \div -.0024 = 416.6667$

Values of r^2: (Used in testing significance of b coefficients)

$r^2_{01.234} = .0018$

$r^2_{02.134} = .0012$

$r^2_{03.124} = .0040$

$r^2_{04.123} = .0019$

fundamentals are as follows: $b_{01.234} = -.2994$, which is the weight assigned to X_1 (chronological age); $b_{02.134} = .0194$, the weight assigned to X_2 (intelligence); $b_{03.124} = -.8775$, the net weight assigned to X_3 (grade); and $b_{04.123} = -.0112$, the weight given to X_4 (socio-economic status).

The multiple-regression equation.-- Knowing the values of the b coefficients, it is possible to write a regression equation that involves four independent variables. The regression equation for the prediction of achievement in arithmetic fundamentals reads

$$\bar{X}_0 = -.2994X_1 + .0194X_2 - .8775X_3 - .0112X_4 + 11.4088$$

This equation is now applied to each of the thirty-seven teachers in the study. For X_1 there is substituted the value of the mean score of the pupils in chronological age; for X_2 is substituted the mean intelligence score, for X_3 is substituted the mean grade, and for X_4 is written the mean score in socio-economic status. The following table (Table 26) contains the computations for predicted growth for each teacher in arithmetic fundamentals.

Table 26. Regression Equation Values for Arithmetic Fundamentals As Applied to Each Teacher or Group.

Teacher	X_1 Chron. Age Weight	Mean Score	X_2 Intelligence Weight	Mean Score	X_3 Grade, Year of Sch. Weight	Mean Score	X_4 Soc.-Ec. Stat. Weight	Mean Score	Constant	Estim. Growth
# 1	-.2994x	10.0	+.0194x	129.0	-.8775x	4.675	-.0112x	49.95	+11.4088	6.2557
# 2	-.2994x	9.4	+.0194x	128.5	-.8775x	4.1	-.0112x	34.0	+11.4088	7.1087
# 3	-.2994x	9.83	+.0194x	136.7	-.8775x	4.9	-.0112x	34.0	+11.4088	6.4371
# 4	-.2994x	10.35	+.0194x	130.85	-.8775x	4.5	-.0112x	34.15	+11.4088	6.5172
# 5	-.2994x	10.5	+.0194x	135.0	-.8775x	5.0	-.0112x	43.0	+11.4088	6.0150
# 6	-.2994x	10.15	+.0194x	125.65	-.8775x	4.5	-.0112x	52.3	+11.4088	6.2729
# 7	-.2994x	10.68	+.0194x	139.9	-.8775x	5.25	-.0112x	26.1	+11.4088	6.0261
# 8	-.2994x	10.54	+.0194x	129.3	-.8775x	4.7	-.0112x	53.95	+11.4088	6.0330
# 9	-.2994x	11.22	+.0194x	136.4	-.8775x	5.325	-.0112x	48.4	+11.4088	5.4810
#10	-.2994x	10.22	+.0194x	127.9	-.8775x	4.5	-.0112x	27.7	+11.4088	6.5721
#11	-.2994x	10.44	+.0194x	127.45	-.8775x	4.825	-.0112x	26.2	+11.4088	6.2283
#12	-.2994x	10.33	+.0194x	132.45	-.8775x	4.675	-.0112x	41.4	+11.4088	6.3195
#13	-.2994x	12.095	+.0194x	139.9	-.8775x	5.675	-.0112x	22.7	+11.4088	5.2677
#14	-.2994x	10.95	+.0194x	137.1	-.8775x	5.0	-.0112x	52.15	+11.4088	5.7285
#15	-.2994x	10.53	+.0194x	138.1	-.8775x	5.0	-.0112x	34.4	+11.4088	6.1624
#16	-.2994x	10.77	+.0194x	136.3	-.8775x	5.0	-.0112x	22.7	+11.4088	6.1868
#17	-.2994x	9.77	+.0194x	119.3	-.8775x	4.0	-.0112x	29.4	+11.4088	6.9588
#18	-.2994x	9.62	+.0194x	121.35	-.8775x	4.0	-.0112x	30.2	+11.4088	7.0346
#19	-.2994x	10.32	+.0194x	144.3	-.8775x	5.325	-.0112x	49.35	+11.4088	5.8930
#20	-.2994x	10.79	+.0194x	129.75	-.8775x	4.725	-.0112x	24.75	+11.4088	6.2721
#21	-.2994x	9.93	+.0194x	120.2	-.8775x	4.0	-.0112x	28.4	+11.4088	6.9396
#22	-.2994x	9.31	+.0194x	130.05	-.8775x	4.05	-.0112x	40.65	+11.4088	7.1352
#23	-.2994x	10.42	+.0194x	123.1	-.8775x	4.5	-.0112x	32.0	+11.4088	6.3700
#24	-.2994x	10.53	+.0194x	139.1	-.8775x	5.0	-.0112x	76.15	+11.4088	5.7142
#25	-.2994x	9.4	+.0194x	125.5	-.8775x	4.0	-.0112x	49.7	+11.4088	6.9620
#26	-.2994x	10.31	+.0194x	124.35	-.8775x	4.275	-.0112x	27.8	+11.4088	6.6717
#27	-.2994x	10.85	+.0194x	132.7	-.8775x	5.0	-.0112x	18.7	+11.4088	6.1378
#28	-.2994x	9.98	+.0194x	123.35	-.8775x	4.0	-.0112x	25.45	+11.4088	7.0188
#29	-.2994x	10.42	+.0194x	149.45	-.8775x	5.0	-.0112x	93.8	+11.4088	5.7503
#30	-.2994x	11.47	+.0194x	142.5	-.8775x	5.85	-.0112x	37.4	+11.4088	5.1369
#31	-.2994x	9.77	+.0194x	122.6	-.8775x	4.0	-.0112x	33.8	+11.4088	6.9735
#32	-.2994x	9.92	+.0194x	141.3	-.8775x	4.7	-.0112x	92.55	+11.4088	6.0191
#33	-.2994x	10.22	+.0194x	138.6	-.8775x	4.85	-.0112x	78.4	+11.4088	5.9037
#34	-.2994x	11.72	+.0194x	145.65	-.8775x	6.0	-.0112x	27.85	+11.4088	5.1485
#35	-.2994x	10.92	+.0194x	131.0	-.8775x	5.0	-.0112x	49.95	+11.4088	5.7339
#36	-.2994x	10.9	+.0194x	134.95	-.8775x	5.0	-.0112x	48.9	+11.4088	5.8281
#37	-.2994x	11.7	+.0194x	137.8	-.8775x	6.0	-.0112x	34.6	+11.4088	4.9266

A Generalized Form of the Regression Equation:

$$\bar{X}_0 = -.2994X_1 + .0194X_2 - .8775X_3 - .0112X_4 + 11.4088$$

The use of the regression equation.-- Following is an example of the use of the regression equation: Teacher #1 has the supervision of a group of twenty pupils. From data on each individual pupil a mean score is computed for the group in chronological age, intelligence, grade, and socio-economic status. The mean scores are as follows: mean chronological age, ten years; mean intelligence score from the Pintner General Ability Test, 129; mean grade of the group, 4.675; mean socio-economic status score, 49.95. These values are substituted in the regression equation which reads

$$\bar{X}_0 = (-.2994 \times 10) + (.0194 \times 129) - (.8775 \times 4.675) - (.0112 \times 49.95) + 11.4088$$

$\bar{X}_0 = 6.2557$ which is the estimated growth in arithmetic fundamentals over a period of one term for this particular group of pupils taught by Teacher #1. This same procedure is followed for each teacher taking part in the experiment.

The coefficient of multiple correlation (R).-- The multiple correlation is expressed by capital R. $R_{0.1234}$ is the symbol used to designate the correlation between the observed growth in arithmetic fundamentals and the predicted growth with the joint effect of chronological age, intelligence, grade, and socio-economic status. This value, $R_{0.1234} = .1342$, is interpreted as the correlation between the observed arithmetic fundamentals mean score and the arithmetic fundamentals score predicted from all the independent variables combined. The formula used to obtain R is $R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0}$

Substituting the values obtained in the multiple correlation table the equation reads

$$R^2_{0.1234} = 1 - \frac{25.4074}{25.8725} = 1 - .9820 = .0180$$

$$R_{0.1234} = \sqrt{.0180} = .1342$$

The next question that arises concerns the significance of this multiple R. To appraise this value of R the formula prepared by Dr. Truman L. Kelley[1/] is used. It is found in the manuscript of his book, "Fundamentals of Statistics." The formula is

$$F_{n,N-n-1} = \frac{V_{0.12...n}/n}{\frac{V_{0.12...n}}{N-n-1}} = \frac{V_0R^2/n}{\frac{V_0(1-R^2)}{N-n-1}} = \frac{\frac{R^2}{n}}{\frac{1-R^2}{N-n-1}}$$

Substituting the known values the formula reads

$$F_{4,735} = \frac{.0180/4}{.9820/735} = \frac{.0045}{.0013} = 3.4615 = t^2$$

$$t = \sqrt{3.4615} = 1.8605$$

From the normal probability curve, 1.8605 is equivalent to an area of .4686 from the mean. The tail area = .50 - .4686 = .0314 = q. 2q = .0628 = p.

This value of p does not pass the criterion of significance, namely .02, but the indications are that the association cannot be accounted for entirely by chance.

1/ Kelley, op. cit., p.--.

Interpretation of the coefficient of multiple correlation in terms of the coefficient of multiple determination (R^2).— R^2 is a measure of the percentage of determination of X_0, by X_1, X_2, X_3, and X_4 combined. In this part of the study $R^2_{0.1234} = .0180$ which indicates that 1.8 per cent. of the variance in arithmetic fundamentals is accounted for by the variances in chronological age, intelligence, grade, and socio-economic status combined. The remaining 98.2 per cent. of the variance must be accounted for in some other way.

Interpretation of the coefficient of multiple correlation in terms of the standard error of estimate.— The standard error of estimate is a measure of the variation or scatter about the line of regression. This scatter of predicted scores along the line of regression is due to the fact that the correlation between the predicted and true scores is not perfect. These deviations from the line of regression are the errors of estimate of the predicted scores for arithmetic fundamentals. The formula used to discover the amount of these deviations is

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2_{0.1234}}$$

Substituting the numerical values for these symbols the formula reads

$$\sigma_{0.1234} = 5.0865 \sqrt{1 - .0180} = 5.0865 \times .9910 = 5.0407$$

This means that about two-thirds of the predicted scores in arithmetic fundamentals will be within 5.04 points of the obtained arithmetic values.

The reliability of the b coefficients.— The b coefficients are also subject to error. Their significance can be estimated by use of the following formula which is taken from the unpublished manuscript

of Dr. Truman L. Kelley's book, "Fundamentals of Statistics."[1/]

$$F_{1(N-n-1)} = \frac{\left[b_{01.12...)i(...\bar{n}-\tilde{b}}\right]^2 \left[V_{i.12...)i(...n}\right] \left[N-n-1\right]}{\left[V_{0.12...x}\right] \left[1-r^2_{0i.12...)i(...n}\right]}$$

Testing for the significance of $b_{01.234} = -.2994$ (chronological age), and substituting the numerical values found in the multiple correlations table, the formula will read

$$F_{1.735} = \frac{-.2994^2 \times \frac{-1}{-1.9616} \times 735}{25.4074 \times (1 - .0018)} = \frac{.0896 \times .5098 \times 735}{25.4074 \times .9982} =$$

$$\frac{33.5895}{25.3617} = 1.3244 = t^2$$

$t = \sqrt{1.3244} = 1.1508$, which is equivalent to a tail area of

$.50 - .3749 = .1251$

$p = .2502$

This result indicates that the weight assigned to chronological age might happen by chance twenty-five times out of one hundred happenings. This weight for chronological age is not significant.

The other b coefficients are tested in the same way. Following is a summary of the results:

$b_{01.234} = -.2994$ (chronological age) ⟺ a tail area of .1251

$p = .2502$

$b_{02.134} = +.0194$ (intelligence) ⟺ a tail area of .1762

$p = .3524$

$b_{03.124} = -.8775$ (grade) ⟺ a tail area of .0427

$p = .0854$

$b_{04.123} = -.0112$ (socio-economic) ⟺ a tail area of .1271

$p = .2542$

Table 27. The Partial Regression Coefficients and Their Significance in the Study of Arithmetic Fundamentals.

b coefficients		Weight	t	p
$b_{01.234}$	Chronological Age	-.2894	1.1508	.2502
$b_{02.134}$	Intelligence	.0194	.9347	.3524
$b_{03.124}$	Grade	-.8775	1.7187	.0854
$b_{04.123}$	Socio-Economic Status	-.0112	1.1439	.2542

The most significant weight is that assigned to grade. This does not meet the criterion for significance but it does indicate that the occurrence is not entirely a chance happening. The grade of a pupil has a slight significance in this study in regard to achievement in arithmetic fundamentals. The least significant variable seems to be intelligence. From observation it would seem that the results of a group intelligence test, in this case the Pintner Mental Ability Test, are not especially significant in these grades when measuring growth in arithmetic fundamentals. The criteria used in evaluating success in arithmetic fundamentals when arranged in order of importance read (1) grade, (2) chronological age, (3) socio-economic status, and (4) intelligence. These weights and their significance are listed in Table 27.

Computation of the teacher-influence score.— The purpose of the regression equation is to obtain an estimated or predicted mean growth score in arithmetic fundamentals for each group of pupils. The estimated growth score for Teacher #1 in this subject is 6.2557. One would expect the pupils under the instruction of this particular teacher to show an average growth during the term of 6.2557 points after considering the chronological age, the intelligence, the grade, and the socio-economic status of the group.

Studying the data available[1] for the pupils in this Teacher #1 group, it can be seen that Pupil #1, Raymond, scored 36 in September and 42 in January when tested in arithmetic fundamentals, which made a

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1/ Appendix, p.144.

[illegible] [illegible] [illegible] [

Table 28. Teacher-Influence Scores in Arithmetic Fundamentals

Teacher	Estimated Mean Arith. Fund. Scores	Observed Mean Arith. Fund. Scores	Teacher-Influence Scores
# 1	6.2557	5.9	-.3557
# 2	7.1087	8.5	1.3913
# 3	6.4371	6.8	.3629
# 4	6.5172	5.85	-.6672
# 5	6.0150	8.2	2.1850
# 6	6.2729	5.35	-.9228
# 7	6.0261	6.35	.3239
# 8	6.0330	4.85	-1.1830
# 9	5.4810	5.7	.2190
#10	6.5721	8.75	2.1779
#11	6.2283	3.4	-2.8283
#12	6.3195	3.2	-3.1195
#13	5.2677	6.4	1.1323
#14	5.7285	6.95	1.2215
#15	6.1624	3.45	-2.7124
#16	6.1868	3.6	-2.5868
#17	6.9588	6.25	-.7088
#18	7.0346	5.75	-1.2846
#19	5.8930	4.2	-1.6930
#20	6.2721	5.3	-.9721
#21	6.9396	10.45	3.5104
#22	7.1352	8.75	1.6148
#23	6.3700	4.65	-1.7200
#24	5.7142	3.35	-2.3642
#25	6.9620	11.55	4.5880
#26	6.6717	5.85	-.8217
#27	6.1378	8.7	2.5622
#28	7.0188	2.45	-4.5688
#29	5.7503	6.45	.6997
#30	5.1869	5.9	.7131
#31	6.9735	7.05	.0765
#32	6.0191	5.4	-.6191
#33	5.9037	5.55	-.3537
#34	5.1485	6.65	1.5015
#35	5.7339	5.65	-.0839
#36	5.8281	4.3	-1.5281
#37	4.9266	4.7	-.2266

growth score of six points. Pupil #2, Everett, increased his first score by eight points at the end of the term. Pupil #3, George, improved his record by one point, and so on down the list. Now the average or mean observed growth score for the entire group is 5.9. If the predicted or expected score is 6.2557 and the observed increase is only 5.9, the lack of growth in this particular case is .3557 or -.3557. This value is called the Teacher #1 influence score in arithmetic fundamentals.

A teacher-influence score in arithmetic fundamentals is computed for each teacher in the experiment. The scores have a range from +4.5880 to -4.5688. These scores are listed in Table 28.

Correlations between the teacher-influence scores and the results of the teacher examinations.-- The last step in the study of arithmetic fundamentals is to discover what relationship exists between the teacher-influence scores and the scores the teacher obtained on her examinations. Since the results of the teacher examinations play a part in the selection of candidates for teaching positions, it is important to know whether the teacher who received a high teacher-influence score also received high scores on the teacher examinations.

Simple correlations are computed between the teacher-influence scores and the scores on the scholastic aptitude test, the scores on the test of professional information, and the general culture test scores. The zero-order coefficients with their significance are shown in Table 29, the first column of which gives the correlations of the teacher-influence scores with scholastic aptitude; the second, those

with professional information; and the third the correlation with general culture. The table shows that teacher-influence in arithmetic fundamentals has a correlation of -.2150 with scholastic aptitude, -.1451 with professional information, and -.0498 with general culture. There is no explanation as to why these small correlations are negative. There is practically no correlation present. The fact that a teacher may receive a high score on the teacher examinations is not an indication that she will so instruct her pupils in arithmetic fundamentals that they will show growth when measured by a standardized test after one term of instruction.

An appraisal of these coefficients of correlation is made according to R. A. Fisher's method of transforming the r to z. The formulas used are as follows:

$$z_r = 1.1512925(\log \frac{1+r}{1-r}) \text{ and } \sigma_{z_r} = \frac{1}{\sqrt{N-3}}$$

1. Teacher-influence arithmetic fundamentals score and scholastic aptitude score:

$$r = -.2150$$

$$z_r = 1.1513(\log \frac{1.2150}{.7850}) = 1.1513(\log 1.5477) = 1.1513 \times .1903 = -.2191$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.2191}{.1715} = 1.2775$$

The obtained z is approximately one and three-tenths as large as its standard. It has no significance.

2. Teacher-influence arithmetic fundamentals score and profes-

Table 29. Coefficients of Correlation of Teacher-Influence Scores in Arithmetic Fundamentals With Percentile Scores on the Teacher Examinations and Their Significance According to R. A. Fisher's Method of Transforming the r to z.

	Scholastic Apt. Examination	Professional Inf. Examination	Gen. Culture Examination
Teacher-Influence Scores in Arithmetic Fund.	$r = -.2150$ $z_r = -.2191$	$r = -.1451$ $z_r = -.1463$	$r = -.0498$ $z_r = -.0477$
Significance of the Correlations	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$	$\sigma_{z_r} = \pm.1715$

sional information score:

$$r = -.1451$$

$$z_r = 1.1513(\log \frac{.1451}{.8549}) - 1.1513(\log 1.3394) = 1.1513 \times .1271 = -.1463$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.1463}{.1715} = .8530$$

The obtained z is a little less than its standard error. It has, of course, no significance.

3. Teacher-influence arithmetic fundamentals score and general culture score:

$$r = -.0498$$

$$z_r = 1.1513(\log \frac{1.0498}{.9502}) = 1.1513 (\log 1.1048) = 1.1513 \times .0414 = -.0477$$

$$\frac{z_r}{\sigma_{z_r}} = \frac{.0477}{.1715} = .2781$$

The obtained z is approximately one-fourth as large as its standard error. There is no significance in this value of z.

Summary.-- The statistical procedure followed in the investigation of teachers' success in teaching arithmetic fundamentals has been described. A multiple regression equation was prepared from the multiple correlation table which was computed according to Dr. Truman L. Kelley's method. The regression equation was applied to each teacher and an estimated growth score was predicted for each teacher. The teacher-influence score was found for each group and these scores were in turn

$$r = .348$$

$$t_r = 1.734\sqrt{\frac{.348}{1-.348^2}} = 1.734\sqrt{\frac{.348}{.879}} = 1.734(.629) = 1.091$$

$$.348 = .348$$

$$\frac{t^2}{df} = \frac{1.091}{.348} = .313$$

correlated with the results of the teacher examinations. Numerical values were found for the multiple R, the coefficient of determination ($R^2_{0.1234}$), the standard error of estimate ($\sigma_{0.1234}$), zero-order correlations, and the significance of the various statistics.

Conclusion.— This study shows no correlation between success in teaching arithmetic fundamentals as measured by a standardized test and the results of teacher examinations in scholastic aptitude, professional information, or general culture. One cannot predict from a study of the teacher examinations which candidate for a teaching position will prove successful in teaching arithmetic fundamentals to pupils in grades four to six.

A summary of statistical data from the multiple correlation table with arithmetic fundamentals as the dependent variable.— A summary of statistical data is presented for the convenience of the reader. This data has already been explained in the preceding pages.

Regression Equation:

$$\bar{X}_0 = -.2994X_1 + .0194X_2 - .8775X_3 - .0112X_4 + 11.4088$$

Coefficient of Multiple Correlation (R)

$$R^2_{0.1234} = 1 - \frac{V_{0.1234}}{V_0} = 1 - \frac{25.4074}{25.8725} = 1 - .9820 = .0180$$

$$R_{0.1234} = \sqrt{.0180} = .1342$$

Significance of Multiple R:

$$F_{n,N-n-1} = \frac{V_{0.12\ldots n}/n}{\frac{V_{0.12\ldots n}}{N-n-1}} = \frac{\frac{V_0 R^2/n}{V_0(1-R^2)}}{N-n-1} = \frac{\frac{R^2/n}{1-R^2}}{N-n-1}$$

$$\frac{\cdots}{\cdots} = \frac{\cdots}{\cdots} \cdot \frac{\cdots}{\cdots} \cdot \frac{\cdots}{\cdots}$$

$$F_{4,735} = \frac{.0180/4}{.9820/735} = \frac{.0045}{.0013} = 3.4615 = t^2$$

$t = \sqrt{3.4615} = 1.8605$ which is equivalent to a tail area of

$.50 - .4686 = .0314$

$p = .0628$

Coefficient of Multiple Determination:

$$R^2_{0.1234} = .0180$$

Standard Error of Estimate

$$\sigma_{0.1234} = \sigma_0 \sqrt{1 - R^2} = 5.0865 \sqrt{1 - .0180} = 5.0865 \times .9910 = 5.0407$$

Significance of b coefficients:

$$F_{1(N-n-1)} = \frac{\left[b_{0i.12...)i(...\bar{n}\tilde{b}}\right]^2 \left[V_{i.12...)i(...n}\right] \left[N-n-1\right]}{\left[V_{0.12...n}\right] \left[1-r^2_{0i.12...)i(...n}\right]}$$

Significance of Coefficient for Chronological Age ($b_{01.234} = -.2994$):

$$F_{735} = \frac{-.2994 \times -1.9616 \times 735}{25.4074 \times (1 - .0018)} = \frac{.0896 \times 5098 \times 735}{25.4074 \times .9982} = \frac{33.5895}{25.3617} = 1.3244 = t^2$$

$t = \sqrt{1.3244} = 1.1508$ which is equivalent to a tail area of

$.50 - .3749 = .1251$

$p = .2502$

Significance of Coefficient for Intelligence ($b_{02.134} = -.0194$)

$$F_{735} = \frac{.0194^2 \times -.0132 \times 735}{25.4074 \times (1 - .0012)} = \frac{.0004 \times 75.7576 \times 735}{25.4074 \times .9988} = \frac{22.2705}{25.3769} = .8736 = t^2$$

$t = \sqrt{.8736} = .9347$ which is equivalent to a tail area of

$.50 - .3238 = .1762.$

$p = .3524$

Significance of Coefficient for Grade ($b_{03.124} = -.8775$)

$$F_{735} = \frac{-.8775^2 \times \overline{-7.5695} \times 735}{25.4074 \times (1 - .0040)} = \frac{.7700 \times .1321 \times 735}{25.4074 \times .9960} = \frac{74.7495}{25.3058} =$$

$$2.9538 = t^2$$

$$t = \sqrt{2.9538} = 1.7187 \text{ which is equivalent to a tail area of}$$

$$.50 - .4573 = .0427$$

$$p = .0854$$

Significance of Coefficient for Socio-Economic Status ($b_{04.123} = -.0112$)

$$F_{735} = \frac{-.0112^2 \times -.0024 \times 735}{25.4074 \times (1 - .0019)} = \frac{.0001 \times 416.6667 \times 735}{25.4074 \times .9981} = \frac{30.6495}{25.3591} =$$

$$1.2086 = t^2$$

$$t = \sqrt{1.2086} = 1.1439 \text{ which is equivalent to a tail area of}$$

$$.50 - .3729 = .1271$$

$$p = .2542$$

PART THREE

APPRAISAL OF RESULTS

CHAPTER X

CONCLUSION

Summary and Recommendations

The problem.-- The use of the National Teacher Examinations as a partial means of helping to select candidates for teaching positions has stimulated interest in this particular fundtion of the examinations. Since the National Teacher Examinations[1] are a recent development, the testing programs are as yet too new to permit an extensive study of their results. This investigation is concerned with the Cooperative Teacher Examinations which preceded the National Examinations in Providence. The Cooperative examinations are substantially similar in parts to the National examinations and are considered by Dr. Ben D. Wood[2] as comparable to them in form and function. Consequently research studies on the Cooperative teacher examinations can be applied to the National Teacher Examinations. This study aims to evaluate the merits of these Cooperative teacher examinations as suitable instruments for use in helping to select desirable teachers. Teacher efficiency in this study is determined by the growth of the pupils in reading and arithmetic over a period of one term as measured by standardized tests.

Other investigations.-- Studies made by other investigators have demonstrated that the correlations between teaching success, as deter-

1/ National Teacher Examinations, 1941 National Teacher Examinations: Suggestions for Their Use in the Selection of Teachers. Cooperative Test Service, 15 Amsterdam Avenue, New York City, May, 1941.

2/ Appendix, p. 140

mined by supervisors' ratings or by the achievement of pupils, and such factors as teachers' intelligence, scholarship, experience, scores on tests, etc., are extremely low and are consequently not predictive.

Statistical treatment of data.-- The multiple correlation technique with five variables has been used in treating the data of this study. The multiple regression equations are used to predict scores for the pupils in reading and arithmetic. The independent variables are chronological age, intelligence, grade, and socio-economic status. Teacher-influence scores are computed and correlated with the results of the teacher examinations.

Results of the study.-- The correlations between the teacher-influence scores and the results of the teacher examinations are too low to indicate any relationship; consequently the teacher examination scores have no predictive value for the type of teaching measured here. The fact that a candidate scores high on the teacher examinations is no indication that her pupils as a group will receive high growth scores in either reading or arithmetic when measured by the standardized tests used in this study.

Limitations of the study.-- Certain limitations of the study have not been overlooked. The length of time allowed (one term) in which to observe growth in pupil achievement may be too short a period. One year or longer might furnish a fairer picture of the growth of pupils, if such a procedure could be followed. This cannot be done at present in the city of Providence as many pupils are under the tutelage of one

teacher for a period of only one term.

The criticism might be made that the ratings of teachers who were appointed over a long period of time are not exactly comparable. Again, some teachers might be most efficient when first appointed and then decline in ability as time passed on. Of the thirty-seven teachers in this study all but four were appointed between 1933 and 1936. This means that all have been teaching practically the same number of years and have had the same opportunities to improve from experience. The fact that the salary schedule is a sliding one and that a teacher may be deprived of an automatic increase in salary because of inefficiency, insures against any decline in effort. It can be assumed, therefore, that as far as the time of appointment is concerned the ratings are comparable and each teacher is probably doing her best work.

The low correlations found in this study may have been affected by the homogeneity of the teachers with respect to college preparation, teacher-training in the same school system under the direction of critic teachers, and a similar type of supervision while teaching. The policy of the city of Providence to give preference to local candidates appears to increase this element of homogeneity.

The limitations of the tests themselves must be recognized. Constant and variable errors may be present although the variable errors tend to be neutralized when the mean scores of the groups are studied. Standardized tests measure best information and skills in the tool subjects. This particular type of achievement is very important but

it should be accompanied by desirable changes in interests, attitudes, and ideals which are more or less intangible and difficult to measure. This study is a consideration of that phase of growth in skills that can be measured objectively by standardized tests and which is considered in this investigation as one important index of teaching efficiency.

Another criticism of standardized tests is their lack of sensitivity. A standardized test that is prepared to cover the achievement of several grades cannot cover extensively the work of each individual grade without being too long for practical use. Tests differ in regard to this quality. The Durrell-Sullivan Reading Test allows for a growth score of seven points in grade 4, seven points in grade 5, and six points in grade 6. The vocabulary test allows a growth of eleven points in grade 4, twelve points in grade 5, and nine points in grade 6. The Stanford test indicates in its norms a growth of ten points in grade 4, eight points in grade 5, and five points in grade 6. It is possible that a test prepared especially for such a study and planned to cover the work developed in each grade might prove to have increased sensitivity.

In regard to the use of intelligence tests, the result of one group test is not considered a very reliable index of the scholastic aptitude of any pupil. As before stated the pupils of Providence are given a group intelligence test in grades 1, 3, 6, 9, and 12. The scores used in this study were obtained on one group test, the Pintner. It was found, from inspection, that the correlation between the Pintner

scores and those received by the same pupils on an earlier test appeared to be very high.

Value of the teacher examinations.-- In the face of these findings it would seem that the Cooperative teacher examinations do not function in the prediction of the type of teaching ability that is measured in this study. This fact does not mean, however, that the tests have no value and should not be used. The sponsors of the National Teacher Examinations, in stressing the merits of the tests, make no claim that the test results will indicate efficiency in teaching. They do claim, however, that the teachers who are successful in the examinations are "more alert intellectually, more broadly cultured, and better informed professionally." These examinations help to select the better educated persons, and surely superior intellect and culture should be no handicaps to good teaching.

Limitations of the teacher examinations.-- The National Committee on Teacher Examinations claim that at the present stage of development the use of the tests in teacher selection is limited to the measurement of the intellect, professional knowledge, and cultural achievement. They also emphasize the fact that the examinations should never be the sole basis for selecting teachers as examinations cannot measure the traits or factors that make up teaching ability. Research studies should continue, for one of the principles of the National Committee on Teacher Examinations is to try to improve the tests and to cooperate with those who are conducting research on teacher selection.

Superintendents reporting on the National Teacher Examinations[1] make suggestions that would improve the value of the tests. It is proposed that these tests be supplemented by tests that would evaluate personality including "emotional stability, social sensitivity, and extroversion." With such improvements the examinations would be invaluable. All realize the value of the examinations in reducing personal pressure, and in helping to eliminate undesirable and politically sponsored candidates for teaching, especially in city school systems.

Since the teacher examinations seem to bear no relation to successful teaching as defined by this study, there might be a question as to the value of these examinations in rating teachers for positions. The same question can be raised, however, about the rating on training and experience, also the rating on personal fitness.

Validity of ratings other than those on examinations.— In Providence the position of a candidate on a list is determined by his score on a one thousand point scale, which is a combination of a possible score of five hundred on the teacher examinations, a maximum of two hundred points for training and experience, and a three hundred point rating in personal desirability. The rating of training and experience is really a rating on preparation for teaching and is determined by the data submitted by the applicant on the application blank for a teaching position. A rating in personal desirability is the result of

1/ Henry H. Hill, "The Role of Examinations in Teacher Selection," New Directions for Measurement and Guidance, American Council on Education Studies, Series 1--Reports of Committees and Conferences, No. 20, (August, 1940) 8. Washington, D. C.

a group judgment at an interview. The Bingham Rating Form[1] is used.

A correlation between data on an application blank and successful teaching is no more assurred than is a relationship between teacher examinations and teaching success. The same can be said of a relationship between an interview rating and success in teaching. In view of the required time, the expense of the examinations, and the functions of the tests as described by the sponsors, the examinations are probably as valid and reliable as the other ratings that are submitted to the superintendent.

Recommendations to Providence administrators.-- It is recommended that the true value and function of the teacher examinations be recognized and that no claims be made that candidates selected on the rating of training and experience, an interview, and the results of teacher examinations will necessarily be successful in teaching tool subjects in the elementary grades. It would seem that another rating might be added to those in use. This would be a rating in real classroom effectiveness given to candidates while they are having student teaching experience and are almost ready for a regular appointment. This additional rating would be a composite mark determined by the critic teacher under whose supervision the candidate has worked, the principal of the school in which the candidate has had practice teaching, and the visiting supervisors and superintendents. Further research should then be made to discover the existing relationship between this new rating in classroom work and pupil achievement. The new rating would be subjective but no more so than an interview rating that is

1/ W. V. Bingham, Rating Form for Use of Interviewers and Oral Examiners--2--1938. International Business Machines Corporation, New York.

now valued at three hundred points. If such a rating would be found to be significant in regard to its relationship with pupil achievement, then the weights or values of the different factors (preparation, personal desirability, teacher examinations) could be readjusted to meet their importance and validity in helping to select potentially successful teachers.

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COOPERATIVE TEST SERVICE
OF THE AMERICAN COUNCIL ON EDUCATION
500 West 116th Street, New York, N. Y.

BEN D. WOOD, *Director*
JOHN C. FLANAGAN, *Associate Director*
DAVID G. RYANS, *Executive Secretary*

June 12, 1944

Miss Marguerite Tully
Department of Research and Guidance
20 Summer Street
Providence, Rhode Island

Dear Miss Tully:

Answering your inquiry of June 2, I think that the results of your researches on the Cooperative tests will be quite applicable to the corresponding parts of the National Teacher Examinations. An inspection of the tests reveals such substantial similarities that no other conclusion would seem to be at all tenable.

With best wishes,

Very cordially yours,

Ben D. Wood

BDW:GT

Ben D. Wood, Director

Table 30. Summary of the Multiple Coefficients of Correlation Between the Four Dependent Variables and the Independent Variables Chronological Age, Intelligence, Grade, and Socio-Economic Status; Also Other Statistical Data.

Col. 1 Criterion	Col. 2 R	Col. 3 R^2	Col. 4 σest.	Col. 5 Significance of R	Col. 6
				t	p
Reading	.2897	.0839	4.2164	4.0988	.00006
Vocabulary	.1020	.0104	5.8096	1.3929	.1646
Arith. Reas.	.1233	.0152	5.5447	1.7097	.0872
Arith. Fund.	.1342	.0180	5.0407	1.8605	.0314

Table 31. Summary of the Zero-Order Coefficients of Correlation Between Teacher-Influence Scores and the Scores Obtained on the Teacher Examinations.

Teacher Examinations	Teacher-Influence Scores in			
	Reading	Vocabulary	Arith. R.	Arith. F.
Scholastic Aptitude	-.0986	-.0295	-.0936	-.2150
Professional Information	.0083	.1269	-.0555	-.1451
General Culture	.0601	.0413	-.0394	-.0498

Table 32. A Summary of Means, Sigmas, and Variances of the Eight Variables Studied.

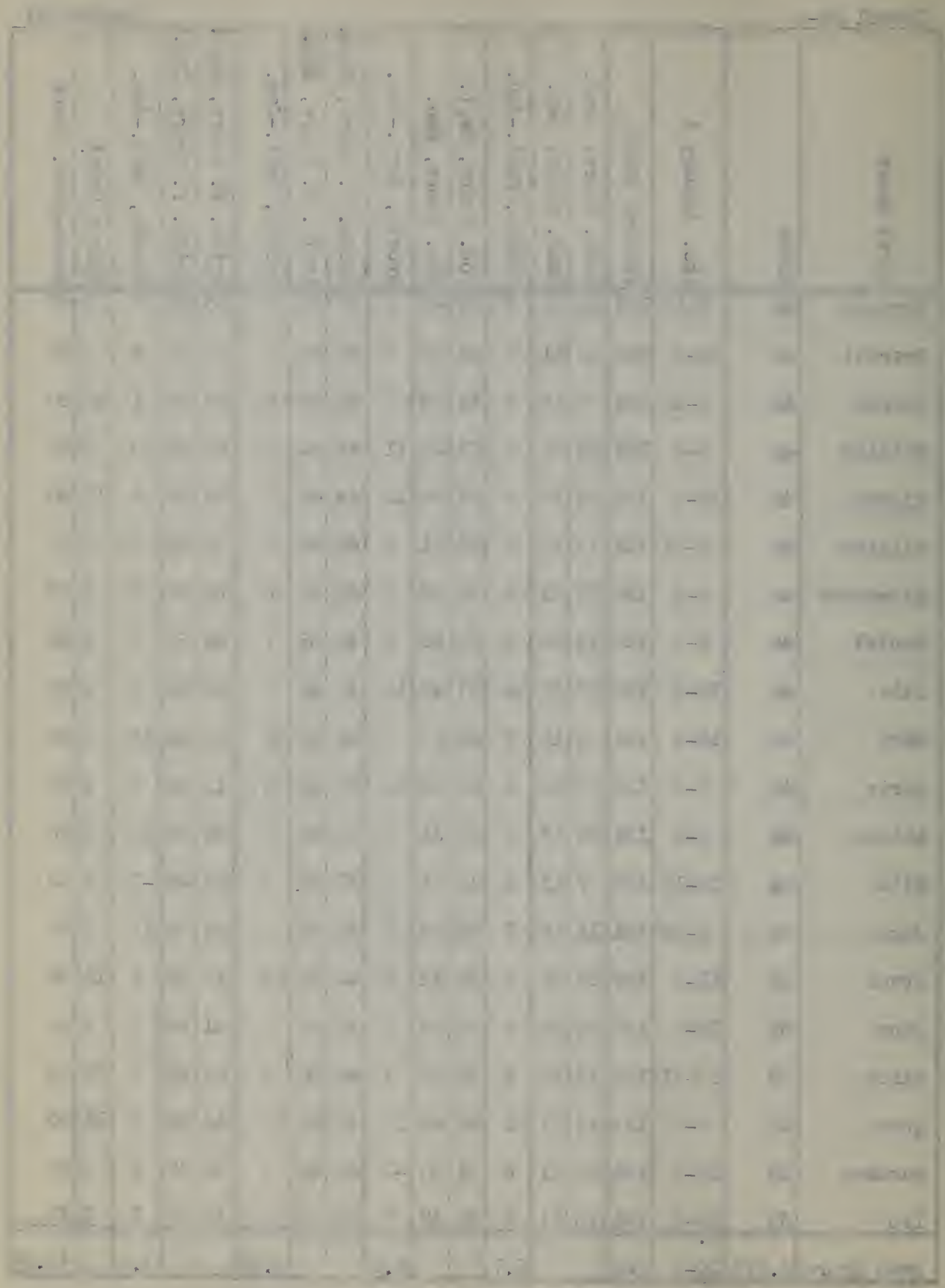
	Mean	Sigma	Variance
Reading	4.3933	5.0034	25.0340
Vocabulary	6.4055	5.8400	34.1056
Arithmetic Reasoning	5.2729	5.5872	31.2168
Arithmetic Fundamentals	6.0070	5.0865	25.8725
Chronological Age	10.4331	.9660	.9332
Pintner Intelligence	132.5945	11.5335	133.0216
Grade	4.9811	.5801	.3365
Socio-Economic Status	42.8110	21.4910	461.8631

Table 33. A Summary of Zero-Order Coefficients of Correlation and Covariances Between the Eight Variables Studied.

	Chron. Age	Pintner Int.	Grade	Socio-Econ.
Reading	r = .0041 CV = .0198	r = .2829 CV=16.3252	r = .1763 CV = .5117	r = .0970 CV=10.4302
Vocabulary	r=-.0533 CV=-.3007	r= -.0854 CV=-5.7522	r=-.0723 CV=-.2449	r= -.0495 CV=-6.2126
Arith. Reas.	r=-.0974 CV=-.5257	r= -.0734 CV=-4.7299	r=-.0816 CV=-.2645	r= -.0442 CV=-5.3073
Arith. Fund.	r=-.1096 CV=-.5385	r= -.0280 CV=-1.6426	r=-.1137 CV=-.3355	r= -.0338 CV=-3.6948
Chron. Age		r= .0797 CV = .8880	r= .6071 CV = .3402	r= -.0958 CV=-1.9888
Pintner Intell.			r= .5319 CV=3.5587	r= .3036 CV=75.2522
Grade				r= .0549 CV = .6844

School #9-A Teacher #1

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Raymond	4A	8-10	132	18	21	3	39	45	6	37	42	5	36	42	6	9	63
Everett	4A	10-4	126	12	21	9	21	28	7	36	44	8	34	42	8	9	63
George	4A	9-10	121	6	13	7	16	25	9	42	42	0	38	39	1	12	50
William	4A	9-6	124	10	12	2	17	28	11	44	53	9	48	48	0	9	63
Richard	4A	10-6	126	14	16	2	24	34	10	44	46	2	30	36	6	12	50
William	4A	9-11	121	15	17	2	28	31	3	42	46	4	30	39	9	9	63
Alexander	4A	9-8	126	13	21	8	32	38	6	40	42	2	39	48	9	2	29
Daniel	4A	9-5	120	14	20	6	22	28	6	48	55	7	44	51	7	9	63
Otis	4A	10-2	128	17	31	14	37	47	10	36	42	6	35	40	5	2	29
Mary	4A	10-8	131	5	12	7	30	35	5	34	46	12	35	46	11	2	29
Marie	4A	9-5	120	16	20	4	30	40	10	38	42	4	41	50	9	9	63
Arline	4A	9-3	136	10	17	7	28	33	5	40	46	6	36	49	13	9	63
Rita	4A	10-10	108	7	11	4	14	21	7	37	42	5	34	29	-5	3	50
Jack	5B	9-10	131	14	16	2	29	35	6	48	57	9	40	52	12	2	29
Irene	5B	11-1	138	22	27	5	39	42	3	42	56	14	49	52	3	12	50
Jane	5B	10-0	159	26	32	6	55	60	5	56	56	0	51	54	3	3	50
Clara	5B	10-11	119	13	16	3	30	37	7	44	50	6	42	49	7	12	50
Queen	5B	9-8	135	14	27	13	38	48	10	42	52	10	45	49	4	12	50
Barbara	5B	10-4	146	27	31	4	51	50	-1	44	50	6	46	49	3	9	63
Leo	5B	10-0	133	15	21	6	40	47	7	38	40	2	40	47	7	2	29
Mean Score	4.675	10-0	129			5.7			6.6			5.85			5.9		49.95



School #40 Teacher #2

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Philip	4B	9-3	123	11	19	8	13	27	14	38	46	8	36	47	11	37	34
Robert	4B	9-0	138	16	15	-1	31	39	8	37	50	13	34	45	11	40	34
Francis	4B	9-4	109	11	13	2	22	28	6	38	48	10	35	47	12	38	34
George	4B	9-4	131	21	24	3	36	40	4	36	44	8	35	44	9	38	34
Albert	4B	9-4	127	9	10	1	12	18	6	32	34	2	36	48	12	40	34
Thomas	4B	10-2	107	5	11	6	18	23	5	30	36	6	28	32	4	39	34
Anthony	4B	9-5	138	19	25	6	38	42	4	34	44	10	34	48	14	38	34
Anna	4B	9-7	113	9	6	-3	21	21	0	34	36	2	36	41	5	37	34
Marie	4B	8-10	137	21	22	1	40	45	5	38	50	12	35	47	12	39	34
Valarie	4B	8-10	128	15	11	-4	36	40	4	42	48	6	41	44	3	37	34
Carol	4B	8-10	157	27	35	8	49	52	3	44	46	2	42	51	9	40	34
Jean	4B	9-0	129	8	12	4	27	38	11	40	50	10	36	46	10	38	34
Emma	4B	9-10	125	10	10	0	26	31	5	36	46	10	36	47	11	37	34
Lavinia	4B	9-7	126	14	13	-1	25	31	6	38	49	11	36	46	10	37	34
Carmella	4B	9-7	136	18	25	7	32	46	14	38	52	14	40	47	7	40	34
Barbara	4B	9-4	127	17	21	4	34	38	4	38	48	10	34	42	8	40	34
Arthur	4A	9-9	130	23	29	6	34	35	1	52	62	10	48	52	4	37	34
Joseph	4A	9-9	128	12	17	5	29	42	13	38	46	8	39	46	7	37	34
Elena	4A	9-7	139	20	24	4	43	45	2	42	52	10	38	47	9	39	34
Dora	4A	9-10	122	10	15	5	31	26	-5	36	40	4	44	46	2	40	34
Mean Score	4.1	9-4	128.5			3.05			5.5			8.3			8.5		34.0

School #32 Teacher #3

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract.	Socio-Econ. Score
Edward	5A	11-7	141	32	34	2	44	60	16	50	59	9	42	55	13	32	34
Elaine	5A	9-11	166	34	38	4	56	65	9	59	72	13	55	62	7	32	34
Viola	5A	10-11	142	27	21	-6	49	51	2	40	56	16	40	50	10	32	34
Joseph	4A	9-7	131	22	33	11	41	56	15	38	38	0	39	45	6	32	34
Leland	4A	8-11	130	11	13	2	24	32	8	44	42	-2	44	51	7	32	34
Marjory	4A	9-1	124	12	21	9	20	29	9	32	44	12	44	47	3	32	34
Eleanor	4A	10-11	115	10	19	9	23	23	0	40	48	8	30	50	20	32	34
Diana	4A-	8-6	146	19	25	6	42	43	1	42	49	7	46	48	2	32	34
Maureen	4A	8-9	129	19	22	3	36	39	3	44	57	13	44	48	4	32	34
Miriam	4A	8-11	141	16	22	6	36	45	9	40	49	9	39	47	8	32	34
Thomas	5B	10-2	144	20	23	3	39	47	8	56	57	1	45	52	7	32	34
Joseph	5B	9-9	134	17	15	-2	31	38	7	44	53	9	47	50	3	32	34
John	5B	10-10	138	26	24	-2	39	47	8	34	42	8	38	47	9	32	34
Jeanne	5B	10-3	130	19	23	4	41	35	-6	40	53	13	50	54	4	32	34
Lillian	5B	9-7	138	20	21	1	40	44	4	50	53	3	49	54	5	32	34
Louise	5B	10-0	148	22	26	4	49	50	1	54	60	6	44	50	6	32	34
Abigail	5B	10-8	129	23	28	5	51	51	0	52	56	4	48	48	0	32	34
Norma	5B	9-3	136	14	23	9	39	48	9	38	60	22	46	52	6	32	34
Anna	5B	10-1	136	20	8	-12	22	29	7	42	52	10	45	52	7	32	34
Charlotte	5B	8-11	136	14	25	11	43	45	2	44	49	5	39	48	9	32	34
Mean Score	4.9	9.83	136.7			3.35			5.6			8.3			6.8		34.0

School #28 Teacher #4

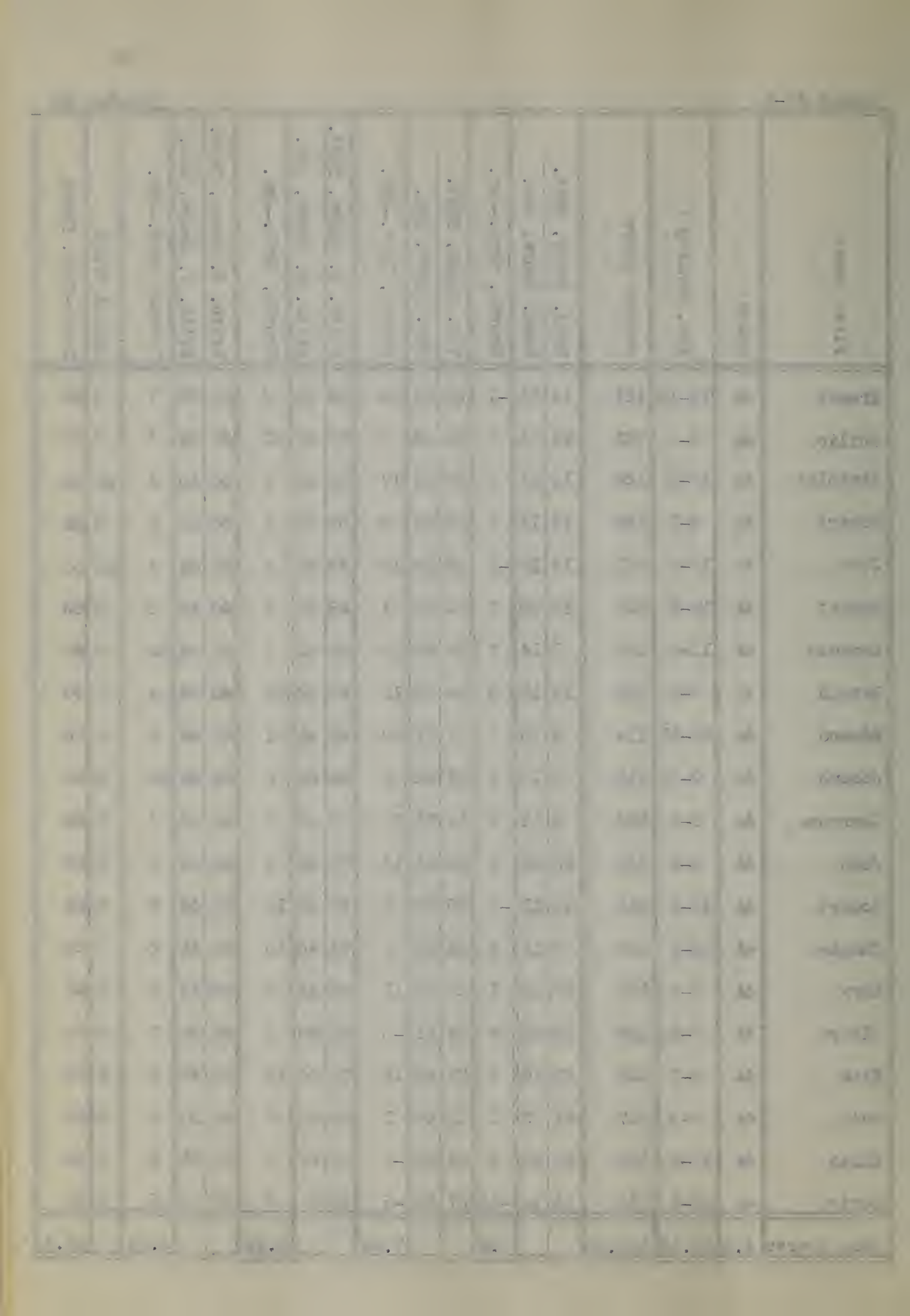
First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Oliver	4A	9-6	128	14	18	4	20	36	16	44	56	12	46	48	2	27	22
Frank	4A	10-1	138	18	22	4	32	43	11	44	50	6	44	48	4	32	34
Donald	4A	9-5	130	23	23	0	32	47	15	54	53	-1	44	50	6	33	63
Nicholas	4A	9-8	142	16	22	6	31	39	8	48	55	7	45	50	5	27	22
Joseph	4A	9-8	142	40	43	3	49	59	10	50	57	7	38	49	11	32	34
Albert	4A	9-6	147	17	19	2	33	35	2	49	63	14	48	50	2	27	22
George	4A	11-0	130	16	20	4	16	32	16	34	42	8	39	41	2	32	34
Raymond	4A	10-1	136	20	30	10	33	47	14	40	52	12	49	52	3	27	22
Alfred	4A	12-4	120	9	12	3	26	27	1	44	49	5	42	42	0	25	22
Florence	4A	9-4	132	19	26	7	27	37	10	42	44	2	44	51	7	32	34
Nancy	4A	9-9	128	11	19	8	31	37	6	49	44	-5	47	51	4	33	63
Mary	4A	10-0	120	16	14	-2	25	37	12	32	46	14	39	44	5	32	34
Anna	4A	11-2	130	9	16	7	20	24	4	36	48	12	38	49	11	32	34
Angela	4A	9-7	137	22	28	6	30	43	13	44	50	6	46	52	6	33	63
Marion	4A	11-6	122	8	15	7	14	29	15	40	48	8	36	49	13	32	34
Mary	4A	9-10	122	19	21	2	22	30	8	42	57	15	41	50	9	28	34
Florence	4A	11-0	122	17	22	5	27	34	7	38	46	8	38	45	7	25	22
Irene	4A	12-8	123	10	12	2	18	25	7	46	50	4	47	50	3	28	34
Joan	4A	9-9	138	23	35	12	41	56	15	36	49	13	36	50	14	28	34
Dorothy	4A	11-2	130	21	22	1	31	43	12	37	49	12	45	48	3	27	22
Mean Scores	4.5	10.35	130.85			4.55			10.1			7.95			5.85		34.15

School #30 Teacher #5

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Ecn. Score
Richard	5B	10-8	142	22	30	8	39	38	-1	52	57	5	42	53	11	29	22
Alfred	5B	10-9	114	9	14	5	16	36	20	32	48	17	34	52	18	29	22
Richard	5B	10-5	141	21	26	5	36	43	7	44	50	6	49	55	6	31	50
Thomas	5B	10-6	131	17	27	10	37	49	12	40	50	10	39	42	3	31	50
Richard	5B	10-8	126	11	22	11	36	46	10	42	53	11	46	52	6	31	50
Jaspar	5B	9-10	135	9	23	14	31	48	17	46	53	7	52	57	5	30	50
Gilbert	5B	10-9	125	16	25	9	31	52	21	46	53	7	51	54	3	29	22
Charles	5B	10-3	130	24	22	-2	33	46	13	42	50	8	42	54	12	30	50
Everett	5B	12-1	158	21	29	8	44	49	5	49	63	14	50	52	2	30	50
Kenneth	5B	10-7	126	20	27	7	32	42	10	37	49	12	46	57	11	30	50
William	5B	9-6	137	25	28	3	49	41	-8	60	62	2	50	63	13	29	22
Elizabeth	5B	12-9	123	16	28	12	39	39	0	36	59	23	41	36	-5	30	50
Claire	5B	9-10	144	24	29	5	51	68	17	59	70	11	51	54	3	30	50
Joan	5B	10-8	159	45	53	8	61	68	7	48	60	12	42	57	15	30	50
Barbara	5B	10-3	141	19	27	8	39	55	16	54	73	19	49	61	12	30	50
Sue	5B	10-2	132	8	24	16	28	47	19	36	49	13	46	55	9	30	50
Janet	5B	10-1	145	22	25	3	41	44	3	54	62	8	52	55	3	30	50
Eolia	5B	10-8	121	19	28	9	39	52	13	37	55	18	40	53	13	29	22
Mary	5B	9-10	135	14	22	8	48	50	2	50	55	5	41	50	9	30	50
Carolyn	5B	9-10	135	22	23	1	51	43	-8	44	53	9	40	55	15	30	50
Mean Scores	5.0	10.5	135			7.4			8.75			10.85			8.2		43.0

School #9-A Teacher #6

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Ernest	4A	11-10	121	14	13	-1	21	31	10	34	34	0	25	32	7	9	63
Philip	4A	9-8	122	24	24	0	35	43	8	36	46	10	39	42	3	9	63
Nicholas	4A	10-5	122	10	15	5	17	34	17	36	42	6	36	40	4	12	50
Robert	4A	9-7	128	10	13	3	17	22	5	32	36	4	40	42	2	9	63
John	4A	10-6	121	18	16	-2	10	20	10	34	40	6	42	46	4	12	50
Robert	4A	10-6	132	13	20	7	32	33	1	38	42	4	40	45	5	9	63
Kenneth	4A	11-4	123	7	14	7	19	29	10	38	42	4	34	44	10	9	63
Harold	4A	9-6	123	18	18	0	24	36	12	40	52	12	40	44	4	3	50
Edmund	4A	12-11	114	8	10	2	7	17	10	38	49	11	42	44	2	9	63
Joseph	4A	9-5	113	8	15	7	16	22	6	32	38	6	24	46	22	9	63
Lawrence	4A	9-9	122	9	11	2	19	31	12	38	42	4	42	46	4	2	29
John	4A	9-4	140	32	36	4	49	63	14	39	48	9	40	40	0	9	63
Robert	4A	10-1	131	18	11	-7	28	36	8	37	55	18	38	44	6	2	29
Charles	4A	10-3	119	9	12	3	23	32	9	34	44	10	39	41	2	2	29
Mary	4A	9-3	131	17	18	1	25	36	11	38	44	6	45	45	0	9	63
Claire	4A	9-4	132	14	20	6	36	31	-5	46	48	2	45	52	7	3	50
Etta	4A	9-9	122	13	16	3	27	40	13	32	44	12	34	42	8	2	29
Ruth	4A	9-5	127	21	23	2	45	46	1	46	55	9	46	50	4	9	63
Edith	4A	10-2	137	21	25	4	44	42	-2	42	48	6	38	46	8	3	50
Doris	4A	10-1	133	24	10	-14	37	32	-5	52	52	0	50	55	5	9	50
Mean Scores	4.5	10.15	125.65			1.6			7.25			6.95			5.35		52.3



School #22 Teacher #7

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Anthony	5B	10-7	156	26	41	15	37	59	22	49	59	10	47	50	3	22	22
Ramon	5B	10-7	141	18	36	18	40	50	10	49	46	-3	40	44	4	22	22
Cyril	5B	10-4	159	50	54	4	68	69	1	63	65	2	47	56	9	22	22
John	5B	10-7	140	15	26	11	28	42	14	38	42	4	35	38	3	33	63
Edward	5B	10-3	131	14	28	14	38	42	4	42	48	6	42	46	4	22	22
David	5B	10-5	138	28	31	3	48	52	4	50	52	2	47	53	6	22	22
Barbara	5B	9-11	144	17	21	4	38	49	11	50	56	6	46	52	6	22	22
Clarinda	5B	10-8	145	25	30	5	46	50	4	52	56	4	46	53	7	22	22
Beverly	5B	10-7	122	18	17	-1	33	31	-2	54	56	2	44	50	6	22	22
Barbara	5B	10-3	154	26	33	7	51	62	11	57	60	3	47	58	11	22	22
Anthony-	5A	10-11	135	19	25	6	30	32	2	44	55	11	44	55	11	22	22
Anthony	5A	10-5	127	19	27	8	44	47	3	54	56	2	47	49	2	22	22
Franklin	5A	9-9	144	24	31	7	28	37	9	46	55	9	44	55	11	22	22
Lawrence	5A	10-5	151	21	29	8	46	55	9	44	50	6	48	52	4	22	22
Peter	5A	11-9	137	14	22	8	32	31	-1	49	49	0	42	49	7	22	22
Joan	5A	10-6	142	23	29	6	40	53	13	49	52	3	38	52	14	22	22
Shirley	5A	12-0	136	20	29	9	41	47	6	44	46	2	44	48	4	22	22
Estella	5A	12-3	126	12	14	2	24	28	4	40	28	-12	42	47	5	22	22
Thelma	5A	11-0	135	21	27	6	31	42	11	46	49	3	48	55	7	22	22
Mildred	5A	10-7	135	21	30	9	46	52	6	50	48	-2	47	50	3	33	63
Mean Scores	5.25	10.68	139.9			6.45			7.05			2.9			6.38		26.1

School #46 Teacher #8

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Paul	4A	9-5	124	14	23	9	29	49	20	34	34	0	30	35	5	36	12
Richard	4A	10-6	128	21	15	-6	29	37	8	46	44	-2	44	45	-1	46	68
Vincent	4A	10-3	128	9	13	4	22	21	-1	37	53	16	39	45	6	36	12
Charles	4A	9-1	137	30	37	7	35	53	18	42	48	6	40	51	11	46	68
Bernard	4A	11-8	133	26	25	-1	36	36	0	42	49	7	36	49	13	46	68
Walter	4A	9-11	120	17	14	-3	24	30	6	36	36	0	34	42	8	35	34
James	4A	10-10	123	16	17	1	36	16	-20	34	36	2	39	36	-3	46	68
Rudolph	4A	11-5	122	15	21	6	29	39	10	34	36	2	39	36	-3	34	34
Janet	4A	9-2	141	20	23	3	40	44	4	34	42	8	35	36	1	34	34
Doris	4A	9-3	135	16	22	6	41	48	7	34	42	8	34	46	11	43	77
Louise	4A	10-8	125	16	22	6	29	40	11	32	38	6	27	32	5	43	77
Beverly	4A	12-2	124	14	13	-1	25	24	-1	36	36	0	40	39	-1	43	77
Albert	5B	11-2	132	14	26	12	38	48	10	34	44	10	36	38	2	36	12
David	5B	11-9	129	8	11	3	38	35	-3	44	42	-2	32	42	10	46	68
Edmondo	5B	11-2	126	14	21	7	32	44	12	37	40	3	41	44	3	36	12
Edwin	5B	11-2	134	21	25	4	45	49	4	42	40	-2	39	44	5	46	68
Rita	5B	9-9	124	10	11	1	32	37	5	37	49	12	35	38	3	43	77
Marian	5B	10-6	125	8	18	10	32	40	8	34	40	6	32	42	10	46	68
Marian	5B	10-8	136	18	24	6	35	40	5	48	46	-2	38	48	10	43	77
Gladys	5B	10-4	140	19	13	-6	42	48	6	42	40	-2	36	36	0	46	68
Mean Scores	4.7	10.54	129.3			3.4			5.45			3.8			4.85		53.95

Pupil name																	
Paul	4A	9-5	124	14	23	9	20	40	20	34	42	0	30	14	5	36	14
Richard	4A	10-0	105	21	13	-6	70	17	0	40	[illegible]	-1	14	[illegible]	-1	60	60
Vincent	4A	10-8	100	8	15	4	42	22	-1	27	[illegible]	[illegible]	33	[illegible]	5	[illegible]	22
Charles	4A	9-1	117	10	51	7	25	30	11	42	49	[illegible]	40	2	11	[illegible]	[illegible]
Bernard	4A	11-0	110	28	23	-1	36	52	0	44	[illegible]	7	31	[illegible]	15	[illegible]	[illegible]
Shirley	4A	8-11	160	17	14	-6	34	30	6	33	38	0	24	42	3	34	34
Janet	4A	10-10	100	18	19	1	36	18	-20	34	[illegible]	2	33	30	-1	[illegible]	[illegible]
Rudolph	4A	11-6	120	14	10	[illegible]	49	[illegible]	110	36	[illegible]	2	[illegible]	30	-4	24	24
Janet	4A	9-2	141	30	[illegible]	2	40	44	4	34	40	[illegible]	[illegible]	35	1	76	76
Doris	4A	9-5	171	16	32	4	40	40	7	34	36	8	34	40	11	40	77
Louise	4A	10-8	115	15	52	[illegible]	23	40	11	28	33	0	27	22	[illegible]	40	77
Russell	4A	11-2	120	14	13	-1	23	34	-1	36	38	0	43	34	-1	40	77
Albert	3B	11-2	130	14	38	10	39	48	13	34	44	[illegible]	36	36	1	[illegible]	12
Gerald	3B	11-8	120	8	11	7	44	[illegible]	-5	34	34	-4	17	[illegible]	20	30	[illegible]
Edmund	3B	11-2	120	16	21	1	33	44	12	37	40	1	13	34	1	30	12
Edwin	3B	11-2	114	11	25	4	42	49	4	40	40	-	[illegible]	40	5	[illegible]	[illegible]
Ella	3B	9-8	124	10	11	1	38	37	3	37	48	12	36	18	6	48	[illegible]
Marian	3B	11-5	123	9	14	10	13	40	8	74	40	8	12	42	17	46	[illegible]
Marion	3B	11-9	130	19	4	6	23	30	5	43	45	-2	39	46	10	42	27
Gladys	3B	11-6	130	13	14	-5	41	45	4	45	40	-4	30	34	0	40	10
Mean	[illegible]	11.4	120.?			[illegible]			[illegible]			[illegible]			[illegible]		[illegible]

School #23 Teacher #9

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Robert	5A	12-2	136	17	28	11	33	46	13	42	42	0	46	47	1	24	34
Edmund	5A	10-9	134	29	31	2	47	54	7	57	62	5	56	60	4	24	34
Herbert	5A	11-3	148	24	31	7	43	51	8	46	53	7	50	48	-2	7	63
Ronald	5A	10-11	148	28	34	6	50	59	9	50	50	0	48	55	7	7	63
Jane	5A	13-7	131	25	29	4	24	29	5	50	57	7	47	51	4	7	63
Norma	5A	11-8	126	14	16	2	24	34	10	49	49	0	48	48	0	18	50
Dolores	5A	11-3	134	18	20	2	41	48	7	54	56	2	42	45	3	23	34
Marlyn	5A	10-11	144	31	40	9	54	59	5	46	50	4	48	49	1	18	50
Charlotte	5A	11-7	135	17	29	12	47	45	-2	48	55	7	44	54	10	23	34
Virginia	5A	12-8	128	15	19	4	45	52	7	48	55	7	45	58	13	7	63
Virginia	5A	10-6	146	25	30	5	44	48	4	59	68	9	48	63	15	6	42
Pauline	5A	10-11	124	23	24	1	49	51	2	40	48	8	48	58	10	24	34
Leonora	5A	11-0	147	24	21	-3	48	49	1	49	50	1	47	54	7	18	50
Edward	5B	10-4	137	20	37	17	40	48	8	48	60	12	42	55	13	7	63
Alvin	5B	11-10	127	14	15	1	36	39	3	52	56	4	45	52	7	24	34
Frank	5B	10-6	140	30	20	-10	43	46	3	56	56	0	47	53	6	24	34
Claire	5B	10-8	142	20	21	1	37	53	16	49	49	0	48	53	5	7	63
Anna	5B	10-10	124	21	23	2	42	47	5	48	46	-2	48	50	2	23	34
Mary	5B	10-2	134	12	19	7	32	36	4	48	53	5	45	52	7	7	63
Lillian	5B	10-11	143	21	24	3	42	49	7	56	59	3	49	50	1	7	63
Mean Scores	5.325	11.22	136.4			4.15			6.1			3.95			5.7		48.4

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School #19 Teacher #10

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Dominico	4A	10-6	119	4	10	6	21	21	0	37	40	3	41	51	10	19	22
Albert	4A	9-2	151	23	32	9	46	50	4	44	57	13	41	53	12	18	50
Bernard	4A	10-3	125	17	22	5	23	33	10	42	46	4	40	48	8	19	22
Paul	4A	11-10	119	10	11	1	5	15	10	36	38	2	40	48	7	25	22
Armando	4A	10-11	129	9	13	4	25	31	6	37	46	9	30	47	17	25	22
Salvatore	4A	10-1	120	6	14	8	24	29	5	38	38	0	42	48	6	24	34
Roco	4A	10-2	124	10	13	3	33	34	1	36	40	4	47	51	4	25	22
Salvatore	4A	9-8	138	21	29	8	36	36	0	40	44	4	47	46	-1	1	29
John	4A	10-3	154	25	41	16	33	51	18	50	50	0	47	55	8	1	29
Vincent	4A	10-1	126	13	18	5	26	37	11	34	34	0	35	33	-2	25	22
Armando	4A	10-10	132	13	17	4	29	31	2	37	36	-1	36	48	12	21	34
Antonio	4A	9-6	127	11	11	0	20	26	6	37	53	16	35	50	15	21	34
Anthony	4A	10-6	129	14	18	4	32	40	8	37	44	7	28	48	20	19	22
Loretta	4A	10-0	109	10	11	1	21	22	1	36	40	4	34	49	15	21	34
Dorothy	4A	10-0	132	9	15	6	29	33	4	40	49	9	44	53	9	25	22
Lucia	4A	10-0	107	10	8	-2	19	18	-1	36	36	0	40	42	2	25	22
Constance	4A	10-6	131	14	17	3	21	28	7	48	46	-2	41	48	7	19	22
Anna	4A	10-3	134	17	20	3	24	34	10	40	42	2	40	50	10	25	22
Anna	4A	10-0	124	8	8	0	27	32	5	30	36	6	44	52	8	21	34
Dolores	4A	9-11	129	13	17	4	31	41	10	42	53	11	38	46	8	21	34
Mean Scores	4.5	10.22	127.95			4.4			5.85			4.55			8.75		27.7

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School #30 Teacher #11

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Bruno	5B	9-7	137	14	21	7	39	43	4	44	52	8	48	49	1	29	22
Americo	5B	10-11	128	17	16	-1	27	36	9	38	52	14	51	54	3	29	22
Louis	5B	11-8	119	12	14	2	35	29	-6	48	52	4	48	53	5	29	22
Anthony	5B	12-5	119	15	16	1	29	35	6	37	42	5	44	45	1	29	22
Alexander	5B	10-8	128	17	21	4	33	38	5	36	40	4	39	42	3	29	22
Donald	5B	10-6	125	20	25	5	32	40	8	38	34	-4	41	48	7	29	22
Angelo	5B	9-10	136	11	18	7	31	38	7	50	50	0	53	55	2	29	22
Anthony	5B	12-1	118	15	20	5	25	40	15	42	44	2	49	48	-1	31	50
Edward	5B	9-11	137	16	24	8	42	55	13	50	53	3	46	55	9	29	22
Theresa	5B	10-0	130	18	18	0	35	45	10	38	49	11	47	49	2	29	22
Carmella	5B	11-2	119	12	19	7	22	36	14	49	48	-1	51	54	3	29	22
Jennie	5B	13-3	125	10	14	4	13	28	15	44	49	5	47	51	4	29	22
Jean	5B	9-11	128	16	17	1	31	40	9	46	48	2	49	49	0	30	50
John	4A	9-5	129	11	17	6	24	41	17	34	46	12	41	48	7	29	22
James	4A	9-7	126	19	22	3	32	33	1	44	42	-2	48	46	-2	29	22
Fred	4A	10-3	133	25	26	1	27	43	16	49	46	-3	46	49	3	29	22
Anthony	4A	9-5	128	21	16	-5	39	43	4	48	48	0	39	48	9	29	22
Vincent	4A	9-4	140	19	18	-1	21	25	4	38	50	12	40	49	9	29	22
Lucy	4A	9-7	124	13	21	8	34	43	9	49	42	-7	40	45	5	29	22
Madeline	4A	9-6	120	14	15	1	32	42	10	48	50	2	54	52	-2	30	50
Mean Scores	4.825	10.44	127.45			3.15			8.5			3.35			3.4		26.2

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School #23 Teacher #12

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Biaggio	5B	10-7	148	19	27	8	42	55	13	62	65	3	49	52	3	24	34
William	5B	10-6	123	19	27	8	29	34	5	44	57	13	42	44	2	7	63
Anna	5B	10-3	138	21	32	11	45	53	8	48	49	1	48	51	3	24	34
Dolores	5B	10-4	144	12	23	11	43	40	-3	52	56	4	48	49	1	23	34
Marie	5B	10-6	127	7	8	1	30	34	4	40	50	10	45	50	5	24	34
Hilda	5B	12-4	124	13	17	4	37	42	5	37	42	5	39	44	5	24	34
Janet	5B	10-5	149	32	45	13	51	65	14	60	59	-1	50	54	4	24	34
Everett	4A	9-7	131	13	22	9	26	33	7	40	42	2	36	42	6	7	63
Raymond	4A	9-8	144	30	33	3	48	53	5	52	55	3	49	48	-1	23	34
John	4A	9-2	128	22	29	7	32	52	20	38	50	12	44	45	1	18	50
James	4A	11-2	122	18	24	6	24	36	12	46	44	-2	38	38	0	23	34
G. Allan	4A	10-0	134	24	30	6	37	46	9	44	53	9	46	48	2	23	34
Robert	4A	12-1	126	14	21	7	27	32	5	44	49	5	46	49	3	7	63
Anthony	4A	10-0	123	9	15	6	19	36	17	49	49	0	46	46	0	24	34
Frank	4A	10-6	123	16	20	4	28	34	6	42	40	-2	35	48	13	23	34
Marilyn	4A	10-4	140	16	20	4	35	43	8	40	46	6	34	36	2	7	63
Eileen	4A	10-0	135	21	26	5	35	46	11	48	50	2	48	48	0	24	34
Gloria	4A	10-0	125	16	17	1	35	34	-1	37	44	7	47	52	5	24	34
Dorothy	4A	9-11	124	12	17	5	23	33	10	38	44	6	40	46	6	23	34
Rosemarie	4A	9-4	141	21	30	9	39	49	10	46	52	6	44	48	4	18	50
Mean Score	4.675	10.33	132.45			6.4			8.25			4.45			3.2		41.4

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School #43 Teacher #13

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Edmund	5A	11-10	130	23	28	5	44	49	5	40	49	9	53	51	-2	42	22
Charles	5A	11-11	159	24	27	3	54	46	-8	42	50	8	44	51	7	42	22
Joseph	5A	11-10	136	24	29	5	47	56	9	44	53	9	49	50	1	42	22
Allyn	5A	11-5	159	37	39	2	55	60	5	56	60	4	47	59	12	42	22
Eugene	5A	11-6	141	31	30	-1	45	51	6	42	50	8	32	48	16	42	22
Dolores	5A	11-8	129	15	24	9	46	51	5	38	44	6	50	59	9	42	22
Cecelia	5A	14-0	138	21	24	3	37	45	8	52	48	-4	60	63	3	42	22
Marcelina	5A	11-8	133	24	25	1	42	51	9	44	52	8	48	51	3	1	29
Ruth	5A	11-5	138	20	20	0	42	45	3	40	46	6	45	55	10	42	22
Alice	5A	11-2	134	19	10	-9	40	41	1	44	46	2	52	55	3	42	22
Marie	5A	11-5	128	16	20	4	30	39	9	36	34	-2	42	47	5	42	22
Dolores	5A	11-9	144	17	20	3	48	47	-1	42	50	8	48	52	4	42	22
Theresa	5A	13-0	134	15	23	8	38	45	7	37	40	3	45	52	7	42	22
Edward	6B	12-6	143	26	23	-3	45	54	9	55	62	7	45	59	14	42	22
Joseph	6B	12-7	140	15	18	3	42	48	6	50	50	0	52	60	8	42	22
Daniel	6B	11-4	159	22	36	14	60	68	8	56	59	3	52	58	6	42	22
Frank	6B	14-4	136	16	16	0	42	48	6	49	44	-5	55	52	-3	1	29
Isabelle	6B	11-4	145	33	31	-2	51	58	7	46	60	14	52	60	8	42	22
Lillian	6B	12-5	142	25	30	5	53	57	4	52	59	7	55	62	7	42	22
Dolores	6B	12-9	130	15	16	1	35	44	9	40	50	10	45	55	10	42	22
Mean Scores	5.675	12.095	139.9			2.55			5.35			5.05			6.4		22.7

School #46 Teacher #14

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Stephen	5B	11-1	143	50	37	-13	45	47	2	46	59	13	42	48	6	43	77
Russell	5B	11-6	154	32	33	1	54	57	3	52	57	5	49	52	3	35	34
Carleton	5B	12-5	137	17	23	6	42	45	3	42	48	6	28	34	6	43	77
Kenneth	5B	11-5	133	17	26	9	31	32	1	46	48	2	36	47	11	43	77
Joseph	5B	10-9	148	21	30	9	59	55	-4	50	49	-1	40	41	1	36	12
Paul	5B	10-9	128	20	23	3	31	43	12	37	38	1	36	39	3	46	68
Theodore	5B	11-6	140	20	21	1	38	47	9	42	57	15	35	45	10	35	34
Harry	5B	10-5	129	9	18	9	26	36	10	46	49	3	39	48	9	36	12
Ernest	5B	10-10	152	31	37	6	59	58	-1	56	65	9	48	54	6	12	50
Beverly	5B	10-7	126	13	18	5	33	32	-1	46	53	7	36	48	12	46	68
Madeline	5B	10-8	136	26	29	3	47	50	3	54	49	-5	48	46	-2	46	68
Gloria	5B	10-10	136	21	24	3	37	48	11	48	55	7	36	50	14	34	34
Nancy	5B	10-3	144	29	36	7	50	56	6	48	55	7	35	52	17	43	77
Genevieve	5B	10-2	138	16	24	8	37	44	7	48	55	7	42	52	10	36	12
Barbara	5B	11-4	122	25	17	-8	29	34	5	48	50	2	40	44	4	46	68
Frances	5B	10-4	144	20	25	5	42	51	9	52	50	-2	46	54	8	46	68
Doris	5B	11-7	129	13	28	15	38	44	6	40	46	6	41	52	11	36	12
Hope	5B	10-11	131	15	20	5	40	46	6	30	38	8	38	41	3	43	77
Sondra	5B	11-3	130	12	16	4	18	29	11	37	50	13	47	49	2	12	50
Lois	5B	10-4	142	27	25	-2	50	43	-7	54	56	2	50	55	5	46	68
Mean Scores	5.0	10.95	137.1			3.8			4.55			5.25			6.95		52.15

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School #19 Teacher #15

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Anthony	5B	11-9	128	18	19	1	28	42	14	50	51	1	48	52	4	30	50
Anthony	5B	11-2	123	6	14	8	23	32	9	40	45	5	44	33	-11	21	34
Vincent	5B	9-9	146	30	35	5	51	58	7	45	56	11	49	60	11	19	22
Anthony	5B	10-6	136	23	20	-3	34	42	8	55	54	-1	51	55	4	24	34
George	5B	10-11	136	19	24	5	29	35	6	47	48	1	44	52	8	19	22
Anthony	5B	10-2	150	27	39	12	58	60	2	60	57	-3	51	62	11	21	34
Lorenzo	5B	10-2	151	23	27	4	44	52	8	52	51	-1	47	57	10	19	22
Alexander	5B	10-5	142	18	28	10	42	53	11	55	56	1	51	60	9	18	50
Kenneth	5B	10-3	139	14	18	4	37	47	10	53	51	-2	49	52	3	1	34
Arlene	5B	10-3	134	14	16	2	18	35	17	40	50	10	48	47	-1	21	34
Lena	5B	10-0	138	15	19	4	30	41	11	50	50	0	49	49	0	21	34
Barbara	5B	10-6	136	22	29	7	39	55	16	36	45	9	46	40	-6	19	22
Teresa	5B	10-11	122	8	14	6	19	30	11	36	43	7	32	36	4	21	34
Anna	5B	12-5	128	10	15	5	19	36	17	34	49	15	47	40	-7	18	50
Barbara	5B	10-3	134	18	22	4	41	43	2	53	48	-5	47	45	-2	24	34
Dolores	5B	10-9	151	31	43	12	49	58	9	53	57	4	46	57	11	21	34
Diana	5B	10-5	142	21	25	4	38	43	5	53	55	2	48	60	12	19	22
Joan	5B	10-0	143	28	30	2	46	47	1	53	54	1	49	52	3	18	50
Lillian	5B	9-9	135	22	25	3	42	44	2	45	57	12	52	55	3	18	50
Joseph	5B	10-1	148	30	37	7	40	45	5	43	46	3	47	50	3	25	22
Mean Scores	5.0	10.53	138.1			5.1			8.55			3.5			3.45		34.4

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School #43 Teacher #16

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Ernest	5B	10-3	141	11	27	16	42	49	7	60	53	-7	51	57	6	42	22
James	5B	11-2	168	42	45	3	66	71	5	50	52	2	43	48	5	42	22
Frank	5B	10-1	124	11	21	10	23	29	6	36	55	19	44	50	6	42	22
Henry	5B	10-3	140	18	18	0	30	36	6	50	50	0	44	47	3	42	22
Anthony	5B	12-7	131	14	17	3	27	28	1	42	59	17	49	52	3	1	29
John	5B	11-9	135	14	18	4	19	31	12	33	47	14	45	49	4	42	22
Albert	5B	11-3	138	18	22	4	36	43	7	42	53	11	44	48	4	42	22
Gerard	5B	10-3	122	13	9	-4	34	38	4	50	52	2	43	41	-2	42	22
Weber	5B	11-7	135	28	34	6	42	45	3	40	42	2	38	39	1	42	22
Antonio	5B	9-10	141	16	21	5	41	47	6	47	40	-7	46	48	2	1	29
Weber	5B	9-9	130	15	17	2	34	40	6	43	45	2	43	43	0	42	22
Anna	5B	9-11	121	17	10	-7	26	29	3	34	42	8	41	44	3	42	22
Dorothy	5B	11-6	131	17	19	2	39	42	3	42	40	-2	43	40	-3	42	22
Jacqueline	5B	10-2	137	16	19	3	31	36	5	42	49	7	33	48	15	42	22
Josephine	5B	11-4	128	9	7	-2	30	35	5	34	49	15	41	44	3	42	22
Anna	5B	10-0	140	27	33	6	47	58	11	42	50	8	45	55	10	42	22
Bemoinda	5B	11-4	138	13	15	2	32	38	6	34	36	2	51	46	-5	42	22
Dolores	5B	10-10	147	18	29	11	37	61	24	49	52	3	41	47	6	42	22
Anna	5B	11-2	143	12	18	6	30	38	8	47	47	0	51	54	3	42	22
Ida	5B	10-6	136	20	19	-1	44	48	4	45	50	5	48	56	8	42	22
Mean Scores	5.0	10.77	136.3			3.45			6.6			5.05			3.6		22.7

School #19 Teacher #17

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Richard	4B	10-3	123	9	10	1	31	38	7	28	36	8	34	38	4	25	22
Ralph	4B	9-2	120	10	14	4	20	22	2	36	46	10	35	40	5	19	22
Angelo	4B	9-5	126	10	11	1	36	44	8	36	34	-2	35	34	-1	25	22
Norma	4B	9-5	121	8	9	1	16	20	4	37	40	3	38	48	10	21	34
Charles	4B	9-7	118	10	14	4	20	30	10	34	42	8	30	44	14	19	22
Ronald	4B	9-7	125	14	18	4	27	33	6	36	48	12	32	36	4	25	22
Peter	4B	9-8	130	22	24	2	29	42	13	36	46	10	38	47	9	18	50
Raymond	4B	8-11	114	10	14	4	11	27	16	44	49	5	36	45	9	19	22
John	4B	10-2	119	12	12	0	24	27	3	38	40	2	35	48	13	19	22
Lucy	4B	10-0	119	7	6	-1	16	18	2	34	34	0	30	32	2	19	22
Lucy	4B	9-3	113	9	12	3	25	25	0	34	40	6	39	36	-3	25	22
Barbara	4B	9-5	124	18	22	4	30	35	5	37	40	3	34	45	11	19	22
Carmela	4B	10-6	110	20	10	-10	17	19	2	32	38	6	32	38	6	25	22
Dorothy	4B	9-11	118	14	15	1	24	34	10	34	44	10	34	45	11	18	34
Dorothy	4B	10-2	119	20	18	-2	28	28	0	30	40	10	30	35	5	21	50
Joyce	4B	9-10	121	7	13	6	25	29	4	34	42	8	35	39	4	18	50
Gloria	4B	10-7	112	15	17	2	19	26	7	36	40	4	34	36	2	21	34
Joan	4B	9-7	118	11	14	3	19	25	6	36	44	8	32	39	7	19	22
Carol	4B	9-4	122	7	12	5	19	23	4	37	44	7	30	38	8	18	50
Josephine	4B	10-8	114	29	36	7	5	29	24	44	32	-12	34	39	5	19	22
Mean Scores	4.0	9.77	119.3			1.95			6.65			5.3			6.25		29.4

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School #19 Teacher #18

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
John	4B	10-6	116	7	14	7	12	15	3	34	42	8	30	36	6	21	34
Frank	4B	10-1	118	13	11	-2	27	31	4	38	42	4	34	35	1	21	34
Thomas	4B	9-4	119	4	7	3	14	17	3	37	44	7	23	39	16	21	34
Sarkis	4B	9-8	118	12	10	-2	11	16	5	38	46	8	35	39	4	21	34
James	4B	9-1	121	8	14	6	30	34	4	40	44	4	39	39	0	25	22
Michael	4B	9-11	121	10	10	0	21	25	4	34	36	2	34	38	4	6	42
Robert	4B	10-2	126	28	35	7	44	49	5	46	48	2	36	45	9	18	50
Peter	4B	9-1	124	13	17	4	22	30	8	38	38	0	32	38	6	25	22
Dolores	4B	9-3	128	13	14	1	20	31	11	44	49	5	38	40	2	25	22
Dolores	4B	9-3	128	9	9	0	21	28	7	42	46	4	34	48	14	25	22
Marie	4B	9-10	115	9	10	1	11	9	-2	32	32	0	30	38	8	21	34
Mary	4B	9-2	115	9	10	1	16	27	11	34	48	14	38	40	2	19	22
Marie	4B	8-7	130	7	12	5	24	21	-3	42	46	4	36	46	10	21	34
Vilma	4B	10-1	123	15	16	1	25	31	6	36	42	6	40	41	1	19	22
Evelyn	4B	9-6	120	10	17	7	31	38	7	37	48	11	34	35	1	25	22
Eleanor	4B	9-8	123	8	14	6	24	35	11	38	40	2	32	40	8	19	22
Eleanor	4B	9-5	120	9	8	-1	23	32	9	36	38	2	35	38	3	6	42
Lucy	4B	11-1	119	3	7	4	9	10	1	38	38	0	36	44	8	21	34
Marlene	4B	9-7	120	8	10	2	16	24	8	36	48	12	36	40	4	21	34
Irene	4B	9-3	123	10	9	-1	23	25	2	37	38	1	30	38	8	19	22
Mean Scores	4.0	9.62	121.35			2.45			5.2			4.8			5.75		30.2

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School #39 Teacher #19

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Walter	5B	11-0	138	18	18	0	41	39	-2	48	50	2	52	54	2	22	22
Vincent	5B	11-4	143	30	26	-4	40	55	15	48	57	9	48	56	8	33	63
John	5B	11-5	137	32	31	-1	46	50	4	52	55	3	50	53	3	39	34
Ronald	5B	10-7	148	23	30	7	50	54	4	62	62	0	50	57	7	39	34
Gelardo	5B	11-1	143	30	26	-4	47	52	5	54	53	-1	49	49	0	33	63
Raymond	5B	12-9	123	26	18	8	16	49	33	52	57	5	54	60	6	39	34
Valia	5B	10-7	135	15	12	-3	29	42	13	42	52	10	49	58	9	39	34
G. James	5A	9-2	157	44	45	1	55	60	5	60	65	5	69	53	-16	39	34
Stuart	5A	9-3	159	29	29	0	45	58	13	57	68	11	52	56	4	33	63
Shant	5A	10-0	139	26	25	-1	47	58	11	46	50	4	52	46	-6	37	34
Albert	5A	9-11	153	24	40	16	36	54	18	56	60	4	52	58	6	33	63
Robert	5A	10-2	150	23	27	4	47	53	6	60	62	2	49	58	9	33	63
A. Joseph	5A	9-11	144	27	36	9	47	53	6	54	57	3	48	56	8	33	63
George	5A	9-7	136	22	25	3	46	52	6	54	59	5	52	56	4	39	34
Barbara	5A	9-6	145	29	36	7	49	58	9	50	55	5	48	53	5	33	63
Leona	5A	10-2	147	37	39	2	56	62	6	62	62	0	53	55	2	33	63
Anne	5A	9-4	156	38	48	10	38	56	18	54	55	1	44	51	7	33	63
Patricia	5A	9-11	148	22	30	8	51	58	7	60	56	-4	51	55	4	33	63
Phyllis	5A	10-4	154	38	41	3	65	65	0	56	53	-3	47	55	8	39	34
Elena	5A	9-10	131	21	29	8	46	51	5	38	59	21	40	54	14	33	63
Mean Scores	5.325	10.32	144.3			3.65			9.1			4.1			4.2		49.35

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School #43 Teacher #20

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Daniel	4A	11-9	124	11	19	8	30	36	6	32	40	8	36	38	2	42	22
Roland	4A	10-2	131	22	25	3	34	40	6	36	42	6	40	44	4	42	22
James	4A	10-9	133	15	19	4	47	37	-10	36	32	-4	34	34	0	42	22
Calvert	4A	9-10	143	20	19	-1	26	36	10	34	38	4	36	46	10	42	22
James	4A	11-9	126	14	15	1	23	27	4	34	36	2	35	47	12	42	22
Antonio	4A	12-4	129	10	14	4	27	25	-2	40	50	10	34	48	14	42	22
Raymond	4A	10-11	128	14	19	5	15	22	7	34	42	8	42	51	9	42	22
Mary	4A	11-7	119	9	16	7	21	27	6	32	30	-2	36	35	-1	42	22
Hilda	4A	11-0	128	15	16	1	31	42	11	32	42	10	30	38	8	42	22
Helen	4A	9-10	130	10	18	8	29	32	3	40	48	8	36	42	6	42	22
Barbara	4A	10-0	136	11	22	11	33	43	10	42	56	14	46	48	2	42	22
Frank	5B	10-2	128	16	19	3	30	39	9	49	49	0	46	49	3	42	22
George	5B	11-2	126	17	19	2	33	43	10	40	55	15	47	48	1	42	22
James	5B	10-7	120	20	21	1	36	43	7	40	52	12	39	39	0	42	22
Charles	5B	10-2	126	16	20	4	29	36	7	36	44	8	36	44	8	42	22
Doris	5B	10-5	140	28	28	0	44	52	8	52	57	5	47	52	5	42	22
Doris	5B	11-11	134	16	21	5	31	36	5	36	38	2	35	42	7	42	22
Alzira	5B	10-8	125	17	22	5	26	30	4	37	50	13	42	45	3	42	22
Beverly	5B	10-8	131	16	19	3	28	47	19	48	50	2	49	49	0	43	77
Irene	5B	10-3	138	19	23	4	45	48	3	42	53	11	39	52	13	42	22
Mean Scores	4.725	10.79	129.75			3.9			6.15			6.6			5.3		24.75

School #19 Teacher #21

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Carmine	4B	10-1	119	15	14	-1	17	23	6	32	40	8	36	49	13	19	22
Gilbert	4B	9-1	134	12	14	2	19	34	15	42	60	18	40	52	12	25	22
Vincent	4B	9-8	113	18	17	-1	12	27	15	34	48	14	38	47	9	19	22
Anthony	4B	9-10	120	6	10	4	11	12	1	34	40	6	32	48	16	19	22
Anthony	4B	9-4	128	10	15	5	16	31	15	44	49	5	42	48	6	18	50
Stephen	4B	9-7	125	8	11	3	9	22	13	36	46	10	32	42	10	25	22
David	4B	10-0	113	8	8	0	5	14	9	32	40	8	32	45	13	21	34
Albert	4B	12-2	114	10	15	5	10	23	13	36	36	0	32	33	1	19	22
Edward	4B	10-6	108	8	10	2	6	16	10	37	38	1	35	46	11	25	22
Michael	4B	9-8	127	11	16	5	20	32	12	42	55	13	38	51	13	25	22
Carmine	4B	9-6	124	6	9	3	18	29	11	36	40	4	39	47	8	25	22
Richard	4B	9-6	115	9	13	4	15	23	8	38	40	2	38	46	8	19	22
Albert	4B	9-5	122	13	10	-3	14	31	17	37	44	7	28	42	14	6	42
Amelia	4B	9-5	118	9	11	2	20	36	16	40	46	6	38	46	8	19	22
Marie	4B	10-9	119	15	14	-1	15	27	12	42	36	-6	32	47	15	19	22
Mary	4B	9-8	121	11	11	0	28	40	12	32	38	6	39	49	10	18	50
Santa	4B	10-5	123	8	9	1	25	24	-1	34	42	8	36	42	6	21	34
Gilda	4B	10-5	117	8	11	3	18	20	2	38	44	6	35	45	10	25	22
Eleanor	4B	10-1	128	4	8	4	25	29	4	36	36	0	35	45	10	19	22
Dorothy	4B	9-7	116	8	11	3	13	24	11	32	40	8	30	46	16	18	50
Mean Scores	4.0	9.93	120.2			2.0			10.05			6.2			10.45		28.4

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School #39 Teacher #22

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
William	4A	9-10	126	19	26	7	29	30	1	38	56	18	38	48	10	39	34
Joseph	4A	10-6	128	9	9	0	11	27	16	34	42	8	39	42	3	39	34
John	4B	9-1	130	12	22	10	43	46	3	36	42	6	28	40	12	39	34
Raymond	4B	9-5	118	7	11	4	18	29	11	36	46	10	38	45	7	39	34
Joel	4B	9-1	124	12	19	7	28	36	8	38	40	2	30	40	10	33	63
Daniel	4B	8-10	136	29	40	11	40	47	7	46	50	4	35	44	9	33	63
Paul	4B	9-10	113	8	10	2	12	25	13	34	36	2	35	42	7	39	34
Eleanor	4B	9-4	140	15	16	1	26	30	4	38	44	6	30	45	15	39	34
Alice	4B	8-9	136	19	22	3	37	42	5	36	49	13	34	34	0	39	34
Claudia	4B	8-11	145	18	29	11	46	51	5	38	56	18	36	44	8	39	34
Mary Jane	4B	9-7	127	18	25	7	35	45	10	38	48	10	40	40	0	39	34
Anna	4B	10-1	130	17	11	-6	37	31	-6	32	38	6	30	40	10	33	63
Dorothy	4B	9-0	134	18	23	5	48	53	5	36	46	10	35	45	10	33	63
Dorothea	4B	9-0	135	20	23	3	39	49	10	37	36	-1	40	44	4	22	22
Patricia	4B	9-9	121	10	21	11	30	38	8	30	36	6	24	44	20	37	34
Joan	4B	8-8	127	14	17	3	35	32	-3	36	49	13	29	46	17	39	34
Dorothy	4B	9-4	132	18	16	-2	36	47	11	40	48	8	34	42	8	37	34
Theona	4B	8-11	146	36	40	4	51	55	4	48	52	4	36	44	8	39	34
Maria	4B	9-1	133	16	27	11	37	44	7	44	49	5	40	48	8	39	34
Judith	4B	9-4	120	9	12	3	13	24	11	38	46	8	35	44	9	33	63
Mean Scores	4.05	9.31	130.05			4.75			6.5			7.8			8.75		40.65

School #19 Teacher #23

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Victor	4A	10-8	125	9	14	5	19	29	10	37	42	5	40	42	2	19	22
Anthony	4A	10-0	120	11	13	2	29	33	4	38	50	12	40	48	8	19	22
Edward	4A	10-3	134	18	21	3	42	52	10	42	52	10	46	48	2	21	34
William	4A	10-6	121	5	20	15	35	35	0	37	38	1	28	38	10	18	50
Alfonso	4A	10-2	122	14	11	-3	22	33	1	42	34	-8	40	44	4	21	34
Salvatore	4A	10-9	126	15	10	-5	24	32	8	34	38	4	34	46	12	19	22
Luigi	4A	10-2	119	10	14	4	12	22	10	32	30	-2	44	49	5	21	34
Vincenzo	4A	10-2	123	12	16	4	22	40	18	37	49	12	47	49	2	18	50
John	4A	10-1	130	16	23	7	42	44	2	42	38	-4	48	51	3	25	22
Luigi	4A	11-0	124	8	10	2	24	33	9	36	44	8	39	49	10	21	34
Raymond	4A	9-7	129	21	15	-6	40	47	7	49	44	-5	48	48	0	18	50
Gladys	4A	10-5	124	15	22	7	30	41	11	44	46	2	42	49	7	6	42
Lorna	4A	10-5	125	8	15	7	15	22	7	36	53	17	42	47	5	21	34
Anna	4A	11-1	123	11	11	0	21	27	6	40	48	8	47	49	2	19	22
Antonetta	4A	10-2	118	14	17	3	25	32	7	44	48	4	44	50	6	25	22
Joan	4A	10-10	118	14	13	-1	31	32	1	46	38	-8	45	48	3	25	22
Bernice	4A	10-6	120	21	22	1	32	39	7	34	38	4	37	48	11	21	34
Diana	4A	11-0	122	17	20	3	32	32	0	42	44	2	48	50	2	25	22
Marie	4A	9-7	123	7	15	8	17	25	8	40	38	-2	44	49	5	21	34
Edna	4A	11-1	116	8	8	0	14	20	6	36	32	-4	42	36	-6	21	34
Mean Scores	4.5	10.42	123.1			2.8			6.6			2.8			4.65		32.9

School #11 Teacher #24

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
John	5B	10-4	146	32	41	9	51	55	4	48	52	4	47	50	3	13	73
Roy	5B	10-1	133	21	26	5	48	42	-6	48	55	7	47	45	-2	13	73
Robert	5B	10-3	138	27	25	-2	60	44	-16	54	55	1	49	49	0	11	73
Robert	5B	10-6	135	22	25	3	35	44	9	50	52	2	44	48	4	13	73
George	5B	9-10	142	24	22	-2	46	48	2	49	52	3	48	53	5	15	80
John	5B	11-0	144	22	34	12	49	47	-2	49	50	1	44	51	7	15	80
J. Raymond	5B	10-4	129	17	22	5	42	47	5	50	53	3	46	47	1	16	84
Lawrence	5B	10-8	134	27	32	5	51	53	2	42	49	7	38	48	10	16	84
Howard	5B	10-4	138	19	31	12	39	45	6	44	48	4	45	48	3	15	80
John	5B	10-4	130	14	21	7	51	46	-5	40	56	16	44	47	3	15	80
Richard	5B	11-0	138	28	17	-11	50	52	2	40	42	2	35	40	5	10	77
Richard	5B	9-11	145	22	30	8	48	46	-2	50	63	13	48	52	4	10	77
Shirley	5B	10-11	135	19	18	-1	35	43	8	46	53	7	51	49	-2	13	73
Ann	5B	10-1	130	14	23	9	41	40	-1	42	48	6	48	50	2	10	77
Pauline	5B	10-1	144	22	30	8	46	54	8	49	50	1	47	50	3	11	73
Gladys	5B	11-11	140	15	19	4	45	32	-13	57	57	0	46	52	6	9	63
Arlene	5B	10-8	153	18	34	16	55	64	9	54	53	-1	48	54	6	10	77
Gail	5B	10-8	153	33	39	6	62	57	-5	56	53	-3	48	49	1	11	73
Norma	5B	10-7	153	25	32	7	39	56	17	59	57	-2	48	55	7	13	73
Norma	5B	11-2	132	26	23	-3	48	43	-5	42	50	8	46	47	1	15	80
Mean Scores	5.0	10.53	139.1			4.85			.85			3.95			3.35		76.15

School #9-B Teacher #25

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
James	4B	9-7	116	8	17	9	24	35	11	36	40	4	30	38	8	2	29
Joseph	4B	9-9	137	23	28	5	39	48	9	44	50	6	28	50	22	9	63
Frederick	4B	10-2	122	12	17	5	26	40	14	37	49	12	38	51	13	3	50
Irwin	4B	8-10	129	13	14	1	39	47	8	34	42	8	39	49	10	3	50
Merlon	4B	10-6	120	14	23	9	28	39	11	36	40	4	26	47	21	3	50
Thomas	4B	9-6	114	10	15	5	13	25	12	37	49	12	26	39	13	9	63
Leonard	4B	8-9	124	24	37	13	40	52	12	48	55	7	40	48	8	9	63
Helen	4B	9-3	141	22	25	3	38	51	13	49	50	1	42	49	7	3	50
Marian	4B	9-2	119	15	16	1	38	51	13	32	44	12	35	46	11	9	63
Gloria	4B	9-2	114	12	12	0	28	40	12	30	32	2	30	36	6	12	50
Adelina	4B	9-4	133	26	21	-5	40	51	11	34	50	16	34	41	7	3	50
Jacqueline	4B	9-4	131	16	21	5	32	44	12	34	40	6	27	36	9	9	63
Thelma	4B	9-4	118	9	12	3	27	30	3	30	36	6	27	28	1	2	29
Florence	4B	9-2	131	10	19	9	30	39	9	34	34	0	34	44	10	3	50
Eilene	4B	9-3	136	27	40	13	52	60	8	49	59	10	39	52	13	3	50
Anahid	4B	9-7	126	7	11	4	11	30	19	36	42	6	32	44	12	2	29
Cynthia	4B	8-10	133	33	43	10	48	52	4	36	38	2	30	50	20	3	50
Eva	4B	9-8	126	13	16	3	31	31	0	30	40	10	34	46	12	9	63
Miriam	4B	9-3	130	15	18	3	34	39	5	40	55	15	39	51	12	3	50
Jane	4B	9-7	110	9	9	0	5	16	11	34	38	4	28	44	16	2	29
Mean Scores	4.0	9.4	125.5			4.8			9.85			7.15			11.55		49.7

School #43 Teacher #26

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Joseph	4A	10-9	126	15	18	3	17	25	8	37	36	-1	35	42	7	42	22
Antonio	4A	11-5	130	13	16	3	17	25	8	38	38	0	40	41	1	42	22
Ernest	4A	10-7	132	20	16	-4	28	41	13	30	34	4	35	39	4	42	22
Norma	4B	10-10	125	8	9	1	19	21	2	32	32	0	35	33	-2	44	80
August	4A	10-4	122	11	20	9	27	36	9	37	42	5	38	45	7	42	22
Mary	4A	10-10	140	11	20	9	33	38	5	36	53	17	44	48	4	42	22
Virginia	4A	10-5	124	23	23	0	38	44	6	36	48	12	35	40	5	42	22
Dolores	4A	11-1	131	12	15	3	26	35	9	38	49	11	41	48	7	42	22
Domina	4A	11-7	122	11	14	3	23	34	11	36	44	8	38	40	2	42	22
Catherine	4A	9-7	133	21	16	-5	40	35	-5	42	55	13	47	48	1	42	22
Helen	4A	11-4	107	7	10	3	6	10	4	34	34	0	34	42	8	42	22
Katherine	4A	10-4	112	9	12	3	24	28	4	32	42	10	30	40	10	42	22
Manuel	4B	9-10	116	10	12	2	29	29	0	36	38	2	27	35	8	44	80
Frank	4B	9-7	127	10	15	5	29	29	0	34	49	15	30	44	14	42	22
Robert	4B	10-1	116	9	14	5	14	16	2	34	48	14	38	41	3	42	22
Manuel	4B	9-7	123	13	15	2	21	27	6	37	38	1	36	46	10	42	22
Ronald	4B	9-6	121	29	28	-1	39	45	6	36	48	12	38	45	7	42	22
John	4B	9-4	128	19	14	-5	35	38	3	32	33	1	35	38	3	42	22
Lauriston	4B	9-8	131	12	17	5	37	41	4	37	42	5	32	44	12	42	22
Irene	4B	9-8	121	6	7	1	8	15	7	30	34	4	30	36	6	42	22
Mean Scores	4.275	10.31	124.35			2.1			5.1			6.65			5.85		27.8

School #41 Teacher #27

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Edward	5B	10-8	136	20	19	-1	36	36	0	52	55	3	48	54	6	41	16
Joseph	5B	10-3	143	24	28	4	45	58	13	46	57	11	50	56	6	41	16
Jack	5B	10-10	149	26	32	6	45	53	8	38	55	17	39	50	11	41	16
Joseph	5B	11-4	139	24	21	-3	41	46	5	52	59	7	48	55	7	40	34
Raymond	5B	10-2	138	20	21	1	36	40	4	46	52	6	38	48	10	41	16
Michele	5B	12-5	126	15	22	7	26	31	5	38	40	2	34	50	16	41	16
Vincent	5B	11-7	133	19	24	5	44	43	-1	37	40	3	29	45	16	41	16
Lawrence	5B	10-7	130	18	17	-1	25	36	11	49	53	4	47	55	8	41	16
Angelo	5B	10-7	131	16	18	2	33	36	3	40	42	2	39	53	14	41	16
Michele	5B	10-7	134	19	22	3	36	37	1	40	59	19	45	53	8	38	34
James	5B	10-8	148	29	36	7	40	49	9	52	57	5	50	52	2	41	16
Thomas	5B	10-5	126	15	18	3	19	19	0	40	48	8	48	51	3	41	16
Gladio	5B	11-4	124	12	17	5	24	25	1	38	38	0	41	50	9	41	16
Anna	5B	10-5	123	11	10	-1	30	36	6	36	44	8	48	56	8	40	34
Henrietta	5B	10-6	109	17	21	4	29	37	8	44	44	0	49	49	0	41	16
Mary	5B	10-5	125	21	16	-5	24	28	4	42	50	8	40	52	12	41	16
Mary	5B	10-11	133	7	12	5	36	35	-1	42	44	2	44	55	11	41	16
Elizabeth	5B	10-11	132	15	21	6	30	36	6	42	49	7	44	54	10	41	16
Gloria	5B	11-4	131	16	16	0	33	31	-2	38	34	-4	35	48	13	41	16
Olga	5B	11-1	144	24	30	6	49	54	5	46	53	7	48	52	4	41	16
Mean Scores	5.0	10.85	132.7			2.65			4.25			5.75			8.7		18.7

School #43 Teacher #28

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Manuel	4B	9-9	113	12	8	-4	8	19	11	27	27	0	41	36	-5	42	22
Arthur	4B	10-8	114	10	5	-5	28	15	-13	33	36	3	33	35	2	42	22
Lino	4B	10-10	129	8	16	8	20	25	5	25	33	8	33	29	-4	42	22
Joseph	4B	10-3	116	6	17	11	12	26	14	33	29	-4	36	39	3	42	22
Richard	4B	9-2	125	6	8	2	12	15	3	33	29	-4	36	47	11	42	22
Richard	4B	9-9	126	16	20	4	44	43	-1	36	29	-7	32	35	3	42	22
Leonard	4B	10-5	118	6	13	7	24	31	7	36	38	2	36	41	5	42	22
Robert	4B	10-5	124	11	21	10	15	20	5	34	29	-5	35	35	0	42	22
William	4B	10-4	116	8	9	1	10	12	2	29	45	16	36	43	7	1	29
Raymond	4B	10-3	121	4	7	3	16	29	13	29	31	2	35	30	-5	42	22
Lawrence	4B	10-4	128	12	18	6	8	21	13	25	31	6	32	32	0	42	22
Joseph	4B	9-10	127	8	17	9	25	20	-5	36	36	0	35	36	1	42	22
Edward	4B	9-9	133	18	22	4	37	40	3	43	43	0	38	38	0	42	22
Alvira	4B	10-1	118	12	9	-3	23	18	-5	33	34	1	33	39	6	43	77
Leonora	4B	10-0	125	15	17	2	12	31	19	38	43	5	39	43	4	42	22
Theresa	4B	9-4	123	13	14	1	24	27	3	36	36	0	39	38	-1	42	22
Gladys	4B	9-7	124	10	14	4	34	35	1	38	42	4	40	44	4	42	22
Victoria	4B	10-5	117	12	11	-1	16	21	5	29	38	9	30	39	9	1	29
Barbara	4B	9-2	145	13	17	4	38	38	0	40	49	9	41	44	3	42	22
Margaret	4B	9-5	125	13	19	6	35	43	8	45	42	-3	39	45	6	42	22
Mean Scores	4.0	9.98	123.35			3.45			4.4			2.1			2.45		25.45

School #49 Teacher #29

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Bryant	5B	10-9	152	30	34	4	60	58	-2	59	63	4	50	53	3	44	80
John	5B	10-0	145	23	26	3	48	50	2	49	49	0	42	51	9	45	98
Alex	5B	10-1	177	55	56	1	63	74	11	59	67	8	42	55	13	45	98
Roger	5B	10-5	136	29	30	1	49	52	3	38	49	11	32	49	17	49	97
Harris	5B	10-2	150	28	34	6	58	59	1	57	55	-2	47	52	5	45	98
Harry	5B	10-4	162	39	49	10	57	64	7	59	56	-3	48	55	7	48	95
Timothy	5B	12-3	148	23	28	5	37	53	16	49	59	10	44	50	6	44	80
Norman	5B	10-7	139	19	28	9	41	49	8	48	50	2	42	48	6	43	77
Nancy Ann	5B	10-2	157	30	41	11	59	62	3	49	55	6	45	50	5	45	98
Barbara	5B	10-3	155	29	44	15	54	66	12	49	53	4	44	51	7	49	97
Eleanor	5B	10-7	140	27	28	1	53	53	0	50	55	5	46	50	4	49	97
Nancy	5B	10-1	140	24	31	7	44	52	8	42	56	14	47	49	2	49	97
Ann	5B	10-5	144	28	31	3	49	50	1	56	56	0	45	52	7	45	98
Mary	5B	10-9	149	41	40	-1	60	65	5	50	52	2	46	51	5	49	97
Mary	5B	10-3	144	12	24	12	42	45	3	60	50	-10	48	53	5	45	98
Patricia	5B	10-5	162	45	50	5	65	69	4	59	63	4	48	55	7	45	98
Beverly	5B	10-7	138	29	31	2	48	55	7	48	55	7	46	50	4	44	80
Edith	5B	10-4	153	39	45	6	68	68	0	62	62	0	46	55	9	45	98
Reva	5B	10-2	143	33	21	-12	55	53	-2	48	57	9	48	51	3	45	98
Barbara	5B	9-11	156	35	38	3	58	60	2	50	57	7	47	52	5	49	97
Mean Scores	5.0	10.42	149.45			4.55			4.45			3.9			6.45		93.8

School #30 Teacher #30

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Donald	6B	12-11	136	15	16	1	39	43	4	56	57	1	54	60	6	30	50
Angelo	6B	12-4	130	11	18	7	32	39	7	40	48	8	48	48	0	29	22
Anthony	6B	11-5	135	16	17	1	18	41	23	46	48	2	48	63	15	31	50
Joseph	6B	11-7	136	18	22	4	41	49	8	49	53	4	45	57	12	29	22
Harry	6B	10-10	150	39	46	7	55	60	5	56	63	7	57	60	3	31	50
Mary	6B	12-3	149	24	28	4	42	47	5	50	62	12	49	57	8	29	22
Marianna	6B	11-3	144	34	43	9	55	62	7	49	53	4	56	55	-1	29	22
Pasqualina	6B	10-11	135	15	18	3	41	46	5	49	60	11	55	58	3	29	22
Louisa	6B	10-9	142	25	33	8	47	51	4	48	59	11	59	66	7	29	22
Celia	6B	13-8	144	22	24	2	37	52	15	54	57	3	47	57	10	26	50
Doris	6B	10-11	139	36	38	2	57	61	4	56	55	-1	57	63	6	30	50
Lillian	6B	10-6	158	32	40	8	64	62	-2	56	67	11	52	59	7	29	22
Ivy Lou	6B	13-0	131	13	16	3	29	38	9	54	56	2	57	61	4	30	50
Nancy	6B	12-3	131	14	18	4	40	42	2	50	55	5	58	62	4	29	22
George	5A	10-0	144	30	31	1	57	50	-7	54	52	-2	48	48	0	31	50
Ernest	5A	10-5	141	18	26	8	37	49	12	52	56	4	48	55	7	30	50
Robert	5A	11-1	155	31	51	20	56	60	4	54	57	3	52	55	3	31	50
Mabel	5A	11-2	158	45	55	10	56	61	5	52	60	8	49	59	10	30	50
Josephine	5A	12-1	125	13	15	2	37	39	2	36	55	19	45	52	7	29	22
Jane	5A	10-3	167	33	48	15	67	70	3	56	60	4	56	63	7	30	50
Mean Scores	5.85	11.47	142.5			5.95			5.75			5.8			5.9		37.4

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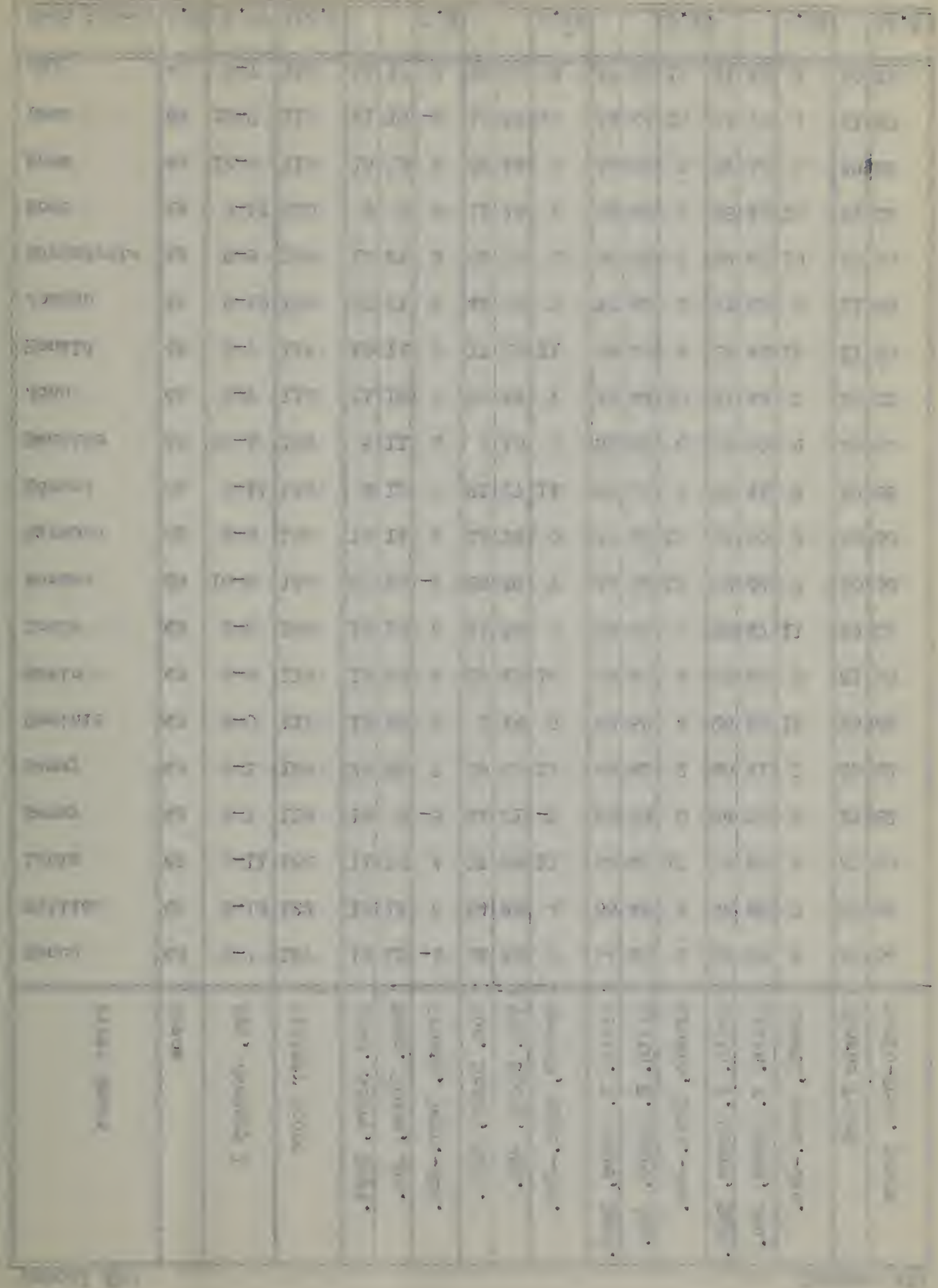
School #30 Teacher #31

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Rocco	4B	9-7	127	18	13	-5	22	28	6	34	38	4	32	38	6	37	34
William	4B	9-10	122	10	13	3	24	28	4	36	40	4	32	39	7	29	22
Louis	4B	9-11	122	11	15	4	17	28	11	34	46	12	35	39	4	31	50
Sammy	4B	9-1	118	16	8	-8	24	21	-3	34	34	0	34	39	5	29	22
Sammy	4B	9-2	138	25	32	7	29	42	13	40	42	2	40	41	1	29	22
Dominic	4B	9-0	113	10	18	8	5	14	9	28	32	4	26	39	13	29	22
Mario	4B	9-5	119	12	20	8	29	43	14	38	44	6	35	40	5	31	50
Louis	4B	9-2	120	12	15	3	31	36	5	36	42	6	36	47	11	29	22
Norman	4B	10-8	134	21	19	-2	29	36	7	40	52	12	38	46	8	30	50
Raymond	4B	9-5	116	12	14	2	25	25	0	36	52	16	32	40	8	30	50
Edward	4B	8-11	125	8	13	5	23	37	14	34	36	2	36	44	8	29	22
Santino	4B	10-4	108	6	11	5	5	10	5	32	32	0	32	40	8	29	22
John	4B	9-7	118	11	16	5	29	36	7	34	44	10	41	44	3	29	22
Ronald	4B	9-7	123	10	15	5	17	28	11	34	38	4	28	44	16	31	50
Joseph	4B	9-10	136	25	31	6	42	49	7	37	42	5	35	40	5	31	50
Marguerite	4B	9-8	130	13	21	8	33	35	2	36	38	2	32	42	10	31	50
Rose	4B	9-11	120	9	9	0	11	15	4	40	49	9	38	48	10	29	22
Anna	4B	12-3	113	16	19	3	32	34	2	40	46	6	32	40	8	29	22
Lena	4B	10-7	118	21	19	-2	19	32	13	34	44	10	34	35	1	31	50
Joy	4B	9-7	132	14	17	3	32	40	8	37	53	16	41	45	4	29	22
Mean Scores	4.0	9.77	122.6			2.9			6.95			6.5			7.05		33.8



School #49 Teacher #32

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Charles	4A	8-8	148	28	35	7	49	54	5	44	55	11	41	47	6	46	68
Ronald	4A	10-8	144	17	15	-2	23	31	8	37	40	3	40	44	4	45	98
Eugene	4A	11-0	138	13	19	6	32	35	3	52	53	1	41	47	6	48	95
Lawrence	4A	9-9	140	27	32	5	30	45	15	48	57	9	42	50	8	45	98
Howard	4A	10-1	146	26	28	2	50	51	1	46	56	10	44	51	7	46	68
Joan	4A	10-0	143	22	33	11	42	47	5	40	50	10	41	50	9	49	97
Nila	4A	9-6	136	16	19	3	36	39	3	42	42	0	47	50	3	44	80
Joan	4A	9-11	133	17	20	3	41	39	-2	38	38	0	39	45	6	45	98
Renec	4A	9-0	126	14	21	7	29	34	5	44	48	4	45	47	2	45	98
Margaret	4A	9-9	134	25	28	3	43	47	4	46	48	2	41	46	5	49	97
Ruth	4A	9-1	144	27	36	9	52	57	5	49	56	7	44	48	4	45	98
Rosilyn	4A	9-7	140	19	21	2	44	45	1	49	50	1	45	47	2	48	95
Robert	5B	9-5	158	25	37	12	56	61	5	54	53	-1	49	54	5	49	97
Frederick	5B	9-11	138	24	22	-2	34	50	16	56	57	1	48	51	3	49	97
William	5B	10-8	147	18	33	15	49	55	6	48	53	5	48	51	3	45	98
James	5B	11-7	134	19	30	11	30	35	5	42	55	13	42	45	3	44	80
Jerrold	5B	10-6	145	27	33	6	44	57	13	54	55	1	42	53	11	45	98
Audrey	5B	9-8	146	29	31	2	40	59	19	50	53	3	41	51	10	49	97
Ann	5B	9-11	142	21	27	6	48	54	6	42	49	7	42	50	8	49	97
Jane	5B	9-11	144	23	36	13	47	55	8	42	46	4	42	45	3	49	97
Mean Scores	4.7	9.92	141.3			5.95			6.55			4.55			5.4		92.55

School #16 Teacher #33

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
James	5B	10-3	134	28	35	7	45	52	7	49	42	-7	39	52	13	16	84
Arnold	5B	10-3	144	41	46	5	58	59	3	57	59	2	50	52	2	16	84
Donald	5B	10-3	148	43	51	8	67	69	2	72	67	-5	55	61	6	17	68
Kenneth	5B	10-7	118	18	22	4	41	46	5	38	48	10	42	48	6	17	68
Patricia	5B	12-5	140	24	45	21	60	60	0	49	55	6	50	55	5	16	84
Roberta	5B	10-0	132	29	34	5	48	52	4	50	49	-1	48	52	4	16	84
Diane	5B	9-7	146	35	48	13	51	56	5	54	55	1	46	56	10	16	84
Shirley	5B	10-0	150	34	37	3	49	54	5	54	63	9	52	59	7	16	84
John	5A	10-7	152	28	40	12	52	65	13	56	57	1	48	56	8	16	84
Geraldine	5A	11-11	128	18	23	5	50	50	0	42	48	6	48	52	4	16	84
Isabelle	5A	10-10	152	25	37	12	50	54	4	52	62	10	52	58	6	16	84
James	4A	9-6	130	15	27	12	28	41	13	44	49	5	38	48	10	17	68
Richard	4A	9-7	144	23	34	11	53	57	4	54	53	-1	52	53	1	16	84
Maurice	4A	9-10	132	22	33	11	39	58	19	42	50	8	40	47	7	17	68
Paul	4A	9-8	135	27	37	10	52	62	10	50	57	7	48	42	-6	16	84
Howard	4A	9-8	134	39	41	2	50	62	12	37	55	18	41	52	11	17	68
Elsie	4A	9-6	149	16	29	13	39	48	9	50	50	0	48	51	3	16	84
Barbara	4A	9-5	135	20	24	4	44	46	2	48	55	7	48	50	2	17	68
Sandra	4A	8-9	150	26	49	23	50	61	11	63	62	-1	47	55	8	17	68
Donald	4A	11-10	119	23	39	16	22	29	7	38	49	11	41	45	4	16	84
Mean Scores	4.85	10.22	138.6			9.85			6.75			4.3			5.55		78.4

School #43 Teacher #34

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Antonio	6B	11-7	158	25	34	9	43	51	8	60	57	-3	54	59	5	43	77
Joseph	6B	11-8	151	30	45	15	58	60	2	68	70	2	63	67	4	42	22
Vernon	6B	10-11	150	28	50	22	59	70	11	62	63	1	45	51	6	43	77
Sidonio	6B	12-6	141	24	23	-1	39	49	10	49	55	6	48	57	9	42	22
Antone	6B	13-1	134	21	25	4	39	41	2	43	52	9	47	54	7	42	22
Julio	6B	11-5	134	18	21	3	31	41	10	65	65	0	53	52	-1	42	22
Gilbert	6B	12-5	143	20	29	9	42	46	4	59	55	-4	45	52	7	42	22
Manuel	6B	12-3	133	20	32	12	43	46	3	57	52	-5	53	63	10	42	22
LeRoy	6B	12-7	141	21	29	8	32	45	13	62	60	-2	50	62	12	42	22
Paul	6B	10-7	157	34	50	16	69	73	4	73	75	2	54	65	11	42	22
Frank	6B	12-2	149	25	33	8	44	50	6	57	59	2	50	52	2	42	22
Eleanor	6B	11-1	161	34	38	4	64	67	3	63	63	0	51	54	3	42	22
Dorothy	6B	11-1	158	28	43	15	59	63	4	72	65	-7	56	69	13	42	22
Diamantina	6B	11-1	148	24	45	21	53	55	2	67	60	-7	54	57	3	42	22
Alice	6B	11-2	138	15	27	12	33	44	11	53	57	4	44	54	10	42	22
Rosaline	6B	11-9	140	56	59	3	48	54	6	60	70	10	47	62	15	42	22
Theresa	6B	11-6	147	27	34	7	56	62	6	67	70	3	56	62	6	42	22
Claire	6B	11-7	143	27	25	-2	50	56	6	68	70	2	57	62	5	42	22
Antonette	6B	12-10	137	18	30	12	49	53	4	53	55	2	51	54	3	42	22
Barbara	6B	11-4	150	20	27	7	40	52	12	59	65	6	54	57	3	1	29
Mean Scores	6.0	11.72	145.65			9.2			6.35			1.05			6.65		27.85

School #23 Teacher #35

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Stuart	5B	12-2	147	26	27	1	50	51	1	52	65	13	49	52	3	23	34
Paul	5B	9-10	138	21	20	-1	39	45	6	38	55	17	41	46	5	23	34
John	5B	10-6	130	20	22	2	37	40	3	42	53	11	44	47	3	24	34
George	5B	10-8	140	17	21	4	32	39	7	44	52	8	49	50	1	7	63
Clara	5B	10-10	117	8	11	3	31	25	-6	37	36	-1	42	49	7	24	63
Norma	5B	10-7	133	15	24	9	41	45	4	44	52	8	50	52	2	24	63
Lorraine	5B	10-4	120	8	15	7	14	16	2	42	49	7	49	47	-2	23	63
Nina	5B	12-11	133	10	14	4	29	32	3	50	52	2	47	53	6	24	63
Ruth	5B	10-5	153	33	36	3	55	61	6	49	53	4	46	54	8	24	63
Mary	5B	11-11	134	18	19	1	26	31	5	38	50	12	48	54	6	23	63
Marie	5B	10-6	119	12	18	6	28	30	2	40	49	9	41	49	8	7	63
Rita	5B	10-5	120	15	17	2	15	30	15	36	26	-10	38	46	8	24	34
Alice	5B	10-11	136	24	26	2	45	50	5	52	56	4	41	54	13	7	63
Ruth	5B	10-1	128	14	18	4	25	34	9	49	55	6	48	52	4	23	34
Dolores	5B	10-7	135	25	19	-6	32	41	9	38	50	12	39	47	8	23	34
Mary	5B	11-4	136	21	22	1	45	48	3	50	55	5	42	48	6	7	63
Marie	5B	11-8	124	16	21	5	37	38	1	49	50	1	44	42	-2	24	34
Anna	5B	11-1	119	16	19	3	26	33	7	49	50	1	47	52	5	24	34
Teresa	5B	10-6	133	19	18	-1	39	41	2	42	48	6	48	50	2	7	63
Marion	5B	11-3	125	15	22	7	26	38	12	49	49	0	32	54	22	24	34
Mean Scores	5.0	10.92	131.0			2.8			4.8			5.75			5.65		49.95

School #9-A Teacher #36

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Gene	5B	10-10	125	12	17	5	31	21	-10	36	36	0	40	50	10	3	50
Salvatore	5B	10-8	133	23	22	-1	48	50	2	56	56	0	44	44	0	12	50
Edward	5B	11-5	130	15	29	14	23	30	7	50	59	9	44	54	10	2	29
Hamazorp	5B	9-9	154	42	55	13	66	65	-1	57	59	2	47	50	3	2	29
James	5B	11-11	147	36	41	5	51	57	6	50	55	5	47	53	6	9	63
Elliott	5B	10-0	127	19	21	2	42	46	4	42	40	-2	38	45	7	3	50
Joseph	5B	10-7	146	32	42	10	59	53	-6	52	56	4	48	51	3	3	50
Louis	5B	10-6	153	33	44	11	50	56	6	52	48	-4	47	51	4	3	50
Michael	5B	12-8	133	13	19	6	30	35	5	46	46	0	45	49	4	2	29
Ann	5B	10-3	128	9	23	14	37	40	3	44	48	4	47	47	0	3	50
Gloria	5B	10-1	140	27	44	17	50	64	14	46	55	9	47	48	1	3	50
Helen	5B	12-0	120	12	15	3	18	26	8	36	42	6	39	50	11	12	50
Emmalina	5B	10-6	125	10	17	7	26	33	7	38	46	8	47	51	4	9	63
Eva	5B	12-0	128	20	20	0	29	33	4	34	30	-4	36	47	11	12	50
Doris	5B	10-8	143	33	36	3	52	56	4	54	60	6	47	50	3	13	73
Maureen	5B	10-3	126	25	16	-9	40	41	1	38	50	12	47	47	0	9	63
Shirley	5B	10-9	127	20	27	7	36	42	6	37	38	1	44	45	1	12	50
Jean	5B	10-8	126	13	21	8	24	34	10	32	36	4	32	38	6	12	50
Sylvia	5B	10-4	154	41	47	6	53	57	4	54	63	9	48	51	3	3	50
Lorraine	5B	12-0	134	19	21	2	39	40	1	48	49	1	49	48	-1	2	29
Mean Scores	5.0	10.9	134.95			6.15			3.75			3.5			4.3		48.9

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School #30 Teacher #37

First Names	Grade	Age, January 1	Pintner Score	Read. Score, Sept.	Read. Score, Jan.	Growth, Sept.-Jan.	Voc. Score, Sept.	Voc. Score, Jan.	Growth, Sept.-Jan.	Arith. R. Score, Sept.	Arith. R. Score, Jan.	Growth, Sept.-Jan.	Arith. F. Score, Sept.	Arith. F. Score, Jan.	Growth, Sept.-Jan.	Census Tract	Socio-Econ. Score
Carleton	6B	11-7	152	32	40	8	62	64	2	59	62	3	55	57	2	30	50
Michael	6B	11-8	142	23	28	5	49	45	-4	56	63	7	57	55	-2	30	50
Anthony	6B	11-5	140	17	33	16	43	49	6	52	57	5	50	55	5	31	50
Frank	6B	10-11	127	19	24	5	36	48	12	40	42	2	49	52	3	29	22
Anthony	6B	11-10	130	28	33	5	50	44	-6	44	65	21	49	61	12	29	22
Anthony	6B	12-7	135	17	20	3	32	40	8	57	62	5	53	58	5	29	22
Carmine	6B	10-11	134	24	28	4	35	46	11	50	59	9	52	57	5	29	22
Lorraine	6B	12-0	136	16	18	2	53	52	-1	37	40	3	57	60	3	29	22
Anna	6B	11-10	131	17	25	8	36	43	7	46	56	10	52	56	4	29	22
Anna	6B	12-2	128	17	22	5	48	53	5	48	50	2	48	51	3	29	22
Elizabeth	6B	10-11	138	13	32	19	44	47	3	44	48	4	45	55	10	30	50
Alba	6B	12-9	132	16	19	3	41	49	8	48	48	0	53	56	3	31	50
Evelyn	6B	11-4	157	30	42	12	63	66	3	54	65	11	60	63	3	29	22
Eleanor	6B	11-6	132	12	17	5	30	40	10	37	53	16	49	58	9	29	22
Lillian	6B	11-9	126	11	15	4	35	47	12	50	49	-1	48	50	2	31	50
Janet	6B	11-5	158	50	44	-6	62	60	-2	49	67	18	60	62	2	31	50
Nancy	6B	10-9	160	35	48	13	67	70	3	57	55	-2	57	58	1	30	50
Stella	6B	12-0	132	17	22	5	37	43	6	42	48	6	45	58	13	31	50
Rose	6B	13-4	134	12	13	1	31	38	7	56	59	3	54	60	6	29	22
Vivian	6B	11-6	134	17	21	4	31	42	11	40	55	15	56	61	5	29	22
Mean Scores	6.0	11.7	137.8			6.05			5.05			6.85			4.7		34.6

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